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AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

OCTOBER 1, 1941



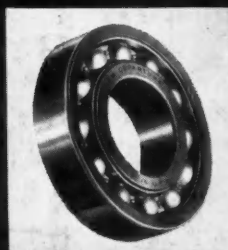
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AUTOMOTIVE INDUSTRIES

THE AUTOMOBILE

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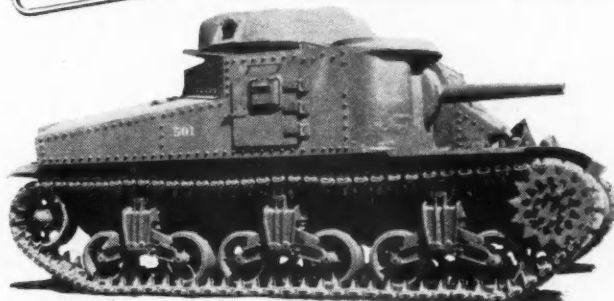
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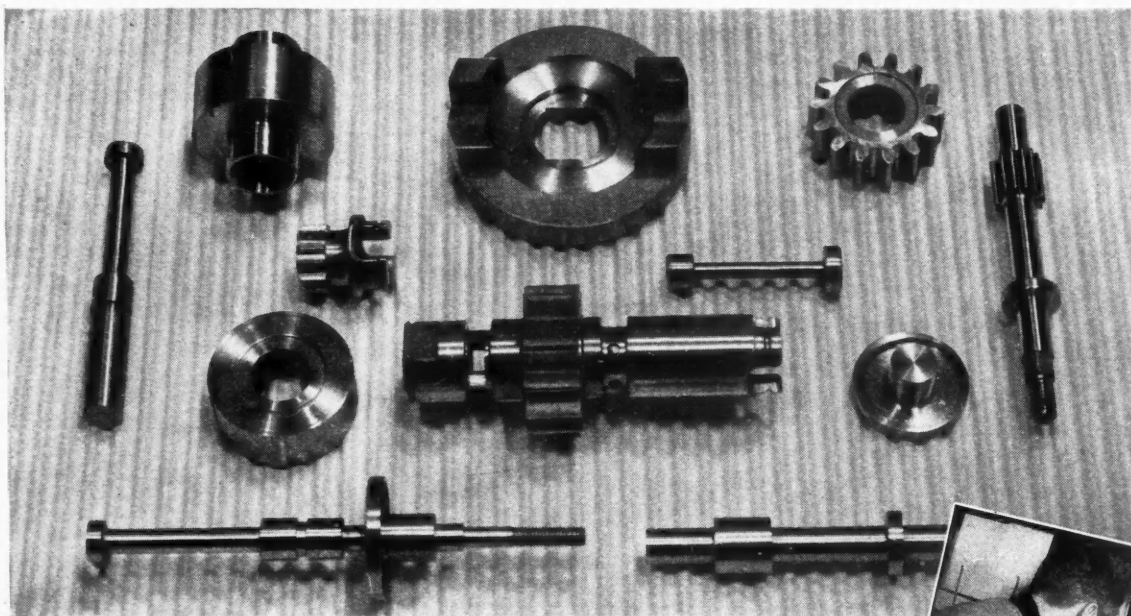
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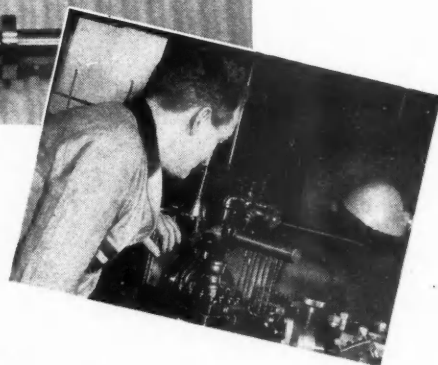
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In This

Production for Defense Issue

of

AUTOMOTIVE INDUSTRIES

(Reg. U. S. Pat. Off.)



October 1, 1941

Vol. 85, No. 7

Automotive Manufacturing Methods Speed Defense Production Page 47

Joseph Geschelin, Detroit Technical Editor of AUTOMOTIVE INDUSTRIES, points out in this comprehensive article how mass production methods borrowed from the regular routine of automobile manufacturers have been adopted to speed up production of munitions of war, including airplanes, aviation engines, guns, shells, tanks, combat and commissary motor vehicles and many other products essential to defense.

The Industry's No. 1 Job Is Production for Defense 54

The automotive industry is turning tons on tons of a wide range of materials into products for our Army and Navy. Its output, measured in amounts of materials used, in hours of machining or in dollar value is setting all-time record highs. E. L. Warner, Jr., AUTOMOTIVE INDUSTRIES' Detroit News Editor, sets forth the highlights of the industry's accomplishments to date which show strikingly how, at sacrifices that in some cases are perilous, it has plunged into the nation's defense effort without hesitation or stint.

Aircraft Manufacture for Defense and a Word About the Future 98

Col. John H. Jouett, President of the Aeronautical Chamber of Commerce of America, reviews, especially for the readers of AUTOMOTIVE INDUSTRIES, the achievements of the manufacturers of airplanes, aircraft engines and aircraft parts; tells how they have doubled their capacity and doubled it again, how they have built many new plants and have augmented their output still further by adopting new methods and employing new equipment. He also outlines the promising possibilities for this part of the automotive industry when the present emergency is over.

As to Critical Metals, How Much Do We Need of This and That 62

The first question to be answered with respect to metals—and we have been a long time in getting it—is how much do we need and how much can we get? So says W. C. Hirsch, Metal Specialist for AUTOMOTIVE INDUSTRIES, in this authoritative survey of the present situation in which he brings out some vital problems, particularly with respect to the shrunken and shrinking supply of scrap essential for adequate steel production.

A Look at Motor Vehicle Production Possibilities 64

How many civilian motor vehicles will be made in the 1942 model year? What are the possibilities for an adequate supply of replacement parts and maintenance equipment to keep our highway transport system functioning as it must for the national welfare? Anybody's guess. But Marcus Ainsworth, Editorial Statistician for AUTOMOTIVE INDUSTRIES, points out many of the factors which may have determining effect and measures the extent of the need that is already influencing and will, undoubtedly, influence still further the Government's thinking and actions with respect to priorities.

The Breakdown of Britain's Civilian Highway Transport 68

M. W. Bourdon, AUTOMOTIVE INDUSTRIES' London Correspondent, gives us an eye-witness account of what happened and is still happening to Britain's privately owned automobiles for passenger carrying and goods transport. It's a lesson from which we can learn much. Don't let it happen here!

We Need Our Automobiles More Than Ever Now 72

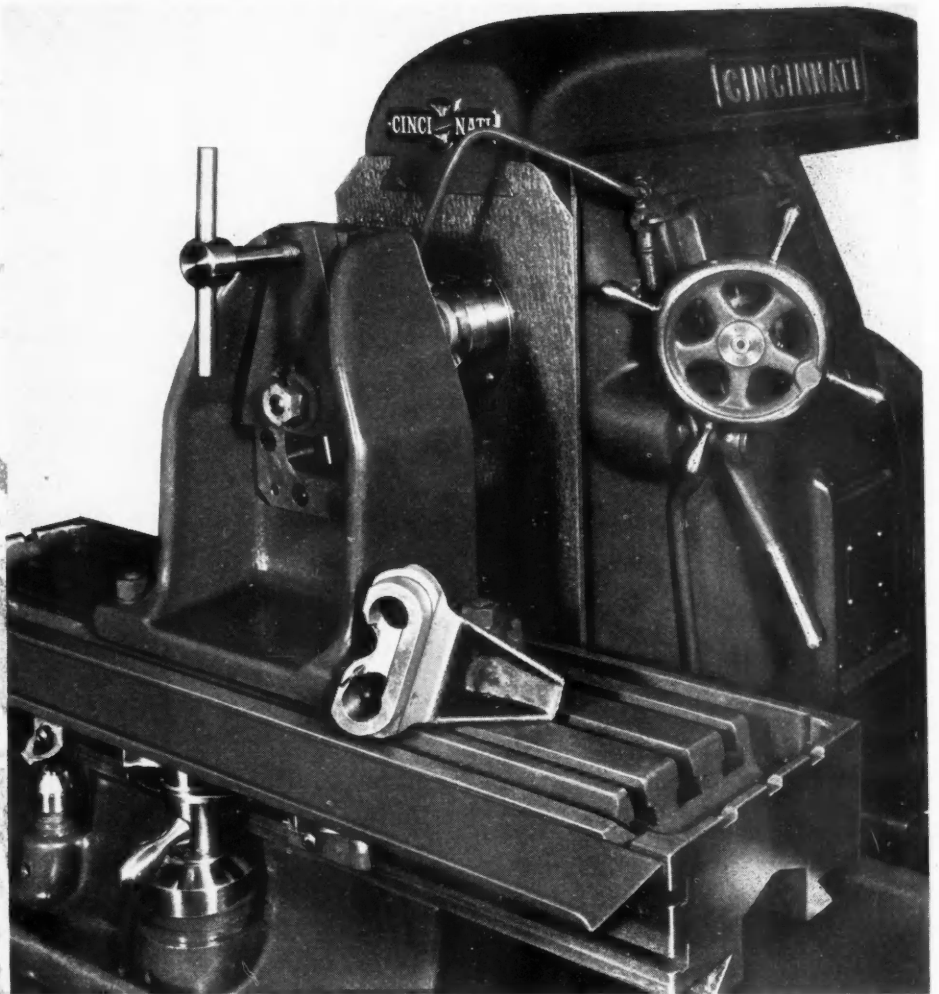
Highway transportation is an essential element in our national economy. Niran Bates Pope tells why and gives examples—a few of the thousands possible—to show how and in what ways America needs its millions of motor vehicles and vitally needs them in these critical days that are on us.

And in Addition

New Materials Handling Equipment, New Production Equipment, New Materials, War Orders of Automotive Manufacturers and the Latest News of the Industry.

TO GIVE TANKS *Sure-Footed* MOBILITY

... MILLING AND BROACHING ARE WORKING TOGETHER



THERE are no roads for army tanks. They must have the sure-footed stamina to push through obstacles, wade creeks, crawl up and down ravines. It follows, then, that the tank track and the parts which compose it are outstanding elements in its mobility. They must be made of exceptionally tough steel and, because there are so many of them, they must also be machined quickly, accurately, and at low cost.

The three machining requirements have been easily fulfilled with the CINCINNATI Milling Machine and Broaching Machines illustrated on this page. They are working together to machine tank parts quickly and at the lowest possible cost.

Above: Milling side of slot in bottom of end connection (tank part) on a CINCINNATI No. 1-12 Plain Automatic Milling Machine. Production, 118 per hour. Write for circular M-848.

Left, top: Broaching two stepped surfaces of end connection (tank part) on a CINCINNATI No. 5-42 Duplex Vertical Hydro Broach. Production, 450 per hour. Write for circular M-894.

Left, bottom: Broaching back face of end plate (tank part) on a CINCINNATI No. 10-54 Duplex Vertical Hydro-Broach. Production, 570 per hour. Write for circular M-894.



THE CINCINNATI MILLING MACHINE CO. CINCINNATI, OHIO, U.S.A.

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Automotive Manufacturing Methods Speed Defense Production

IN THESE trying times, let it be noted that wherever one goes into the plants of the industry engaged in defense work, there is ample evidence that automotive manufacturing methods have provided the means and the skills for placing on a mass production basis the making of airplane engines, airplane frames, ordnance materiel, and the other items required by the military services of the nation.

Fortunately for our country and for the other countries who look upon the U. S. as the "arsenal of democracy," we have been blessed with an automotive industry whose influence over a period of several decades has done more to advance the course of manufacturing, metallurgy, research, and transportation than any other activity since the dawn of the industrial revolution in Europe.

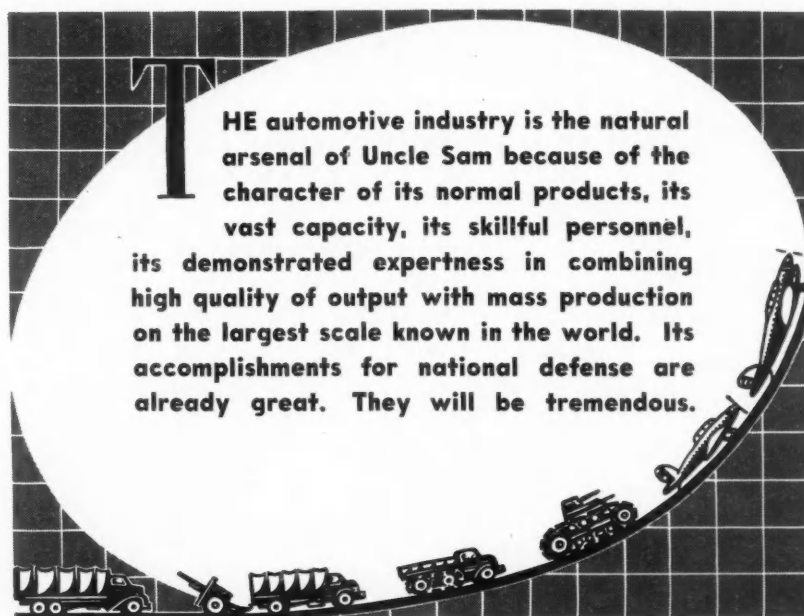
Never before in the history of the world has there been so great a demand for the materials and weapons of war. And never before have such vast quantities of these materials been required in so short a time. Early this year, the members of the automotive family had taken on something over two billions of dollars worth of defense contracts. It is safe to say this figure will be doubled or trebled

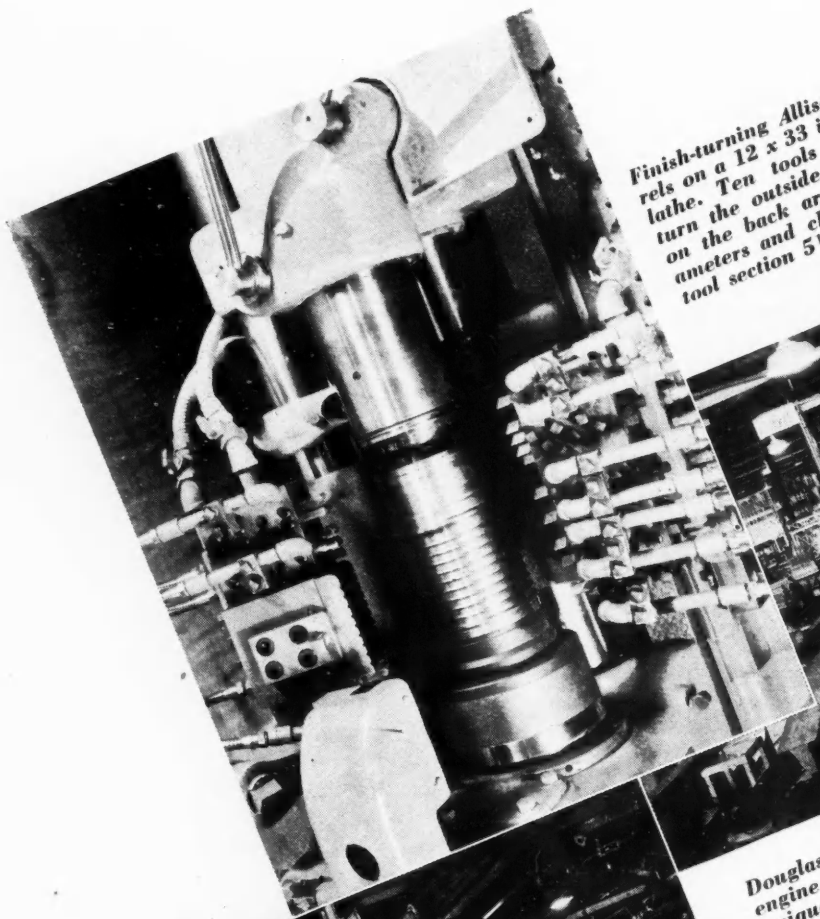
as the defense effort gathers momentum.

It is well for the country that the automotive industry pioneered the basic principles of interchangeable mass production, that over a period of years it has developed the methods, the tools, and men to enlarge and improve the applications of these basic principles. How well these specialized skills have been bent to the needs of volume production of airplanes, airplane engines, large tanks, military vehicles, shells, cartridge cases, machine guns, and the like, already is a matter of record. In fact, much of this activity has been recorded in the file of AUTOMOTIVE INDUSTRIES in this crowded year.

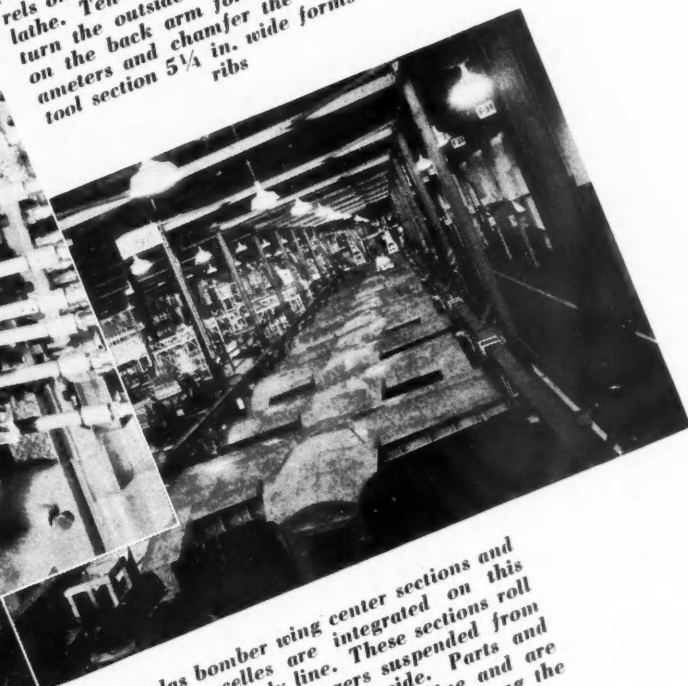
Another important point is that the automotive industry has encouraged and fostered the parallel development of a widespread machine tool industry, as well as a progressive group of cutting tool producers who have given us the cemented-carbides and cast alloy materials so basic to the maximum productivity of machine tools.

In the light of current developments, it is useful to visualize the impact of this technical progress on the defense program—first, in a generalized picture, then in the form of actual examples taken as a sampling of industry-wide activity. Let us consider the generalized pic-

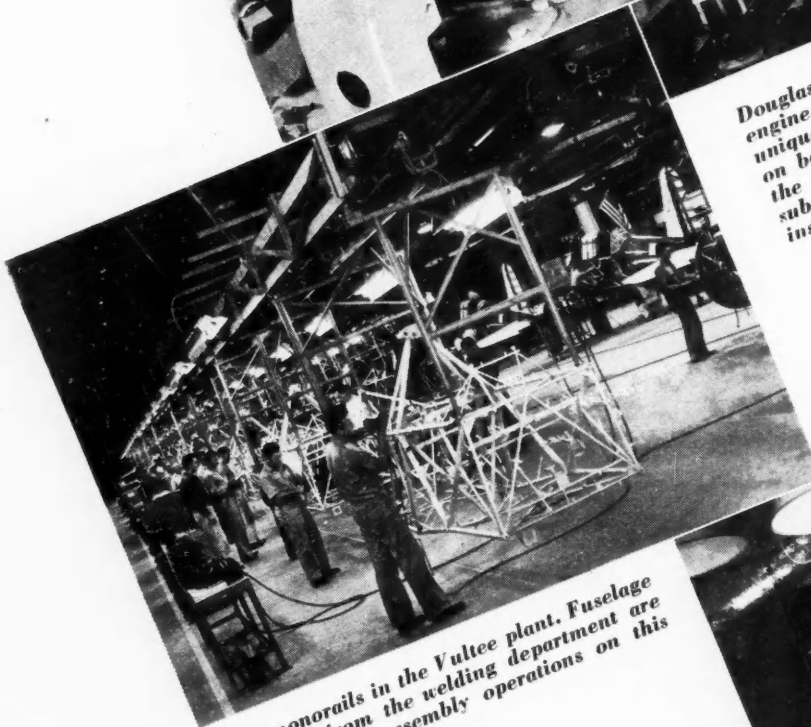




Finish-turning Allison cylinder barrels on a 12 x 33 in. Fay automatic lathe. Ten tools on the carriage turn the outside while seven tools on the back arm form various diameters and chamfer the ends. A tool section 5 1/4 in. wide forms the ribs



Douglas bomber wing center sections and engine nacelles are integrated on this unique assembly line. These sections roll on ball-bearing hangers suspended from the monorails on each side. Parts and sub-assemblies flow to this line and are installed at the proper points along the route



Moving on monorails in the Vultee plant. Fuselage frames coming from the welding department are carried through 25 assembly operations on this line



A Bullard V-T-L machine is used by Lycoming for boring and facing operations on a Curtiss propeller hub

ture in outline—

1. Machine tools—as a direct result of the needs of mass production, there was made available the host of equipment so essential in defense production—precision boring machines, precision thread grinders, multiple-spindle drilling, tapping, and boring machines, precision grinders of every type, surface broaching machines, automatic lathes and turret lathes of various kinds, heavy duty precision milling machines, the modern hydraulic presses, precision honing equipment, and so on.

2. Metallurgy—because the automotive industry demanded and encouraged the development of the finest ferrous and non-ferrous metals possessing exceptional physical properties, durability, and good machinability, it has been possible to make the weapons of war more powerful, more durable, and with mobility hitherto unknown.

3. Materials Handling—mass production principles have developed the science of materials handling, have made available the conveyor systems, the power cranes and hoists, the industrial trucks, that are being exploited to the fullest extent in facilitating the smooth flow of defense work on the machine lines.

4. Surface Finish—engineering talents and production techniques have been bent for a long time to the requirements of fine surface finishes for certain parts of the mechanism. This has been related to the wider uses of precision boring machines, precision grinders, honing machines, lapping machines, Superfinish equipment, etc. And it has been supplemented with instrumentation such as the Abbott Profilometer, the Brush Surface Analyzer, Magnaflux, P & W Electrolimit gage, Sheffield gages, etc. These techniques and instrumentation have proved to be of inestimable value in the defense effort, particularly in the production of aircraft parts where surface finish is so important.

Too, these things have made it feasible to widen the horizon of sub-contracting, since instrumentation makes it possible to work according to reproducible standards.

5. Gear Practice—the requirements of “silent” gear trains, of durable gears of uncommonly small physical size, and of long-lived highly stressed gears—has dominated the thinking of automotive experts during the past ten years and has resulted in the availability of methods and equipment without which it would be almost impossible to produce aircraft gearing in large volume. Improved methods of gear shaping and hobbing, shaving and lapping, precision grinding where needed, and allied techniques all contribute to the steady increase in the production of the finest aircraft gearing known to the art.

With this perspective of the generalized picture, let us turn to actual examples in various areas of defense work. This discussion will be supplemented with a pictorial section providing a sampling of activity in many different plants.

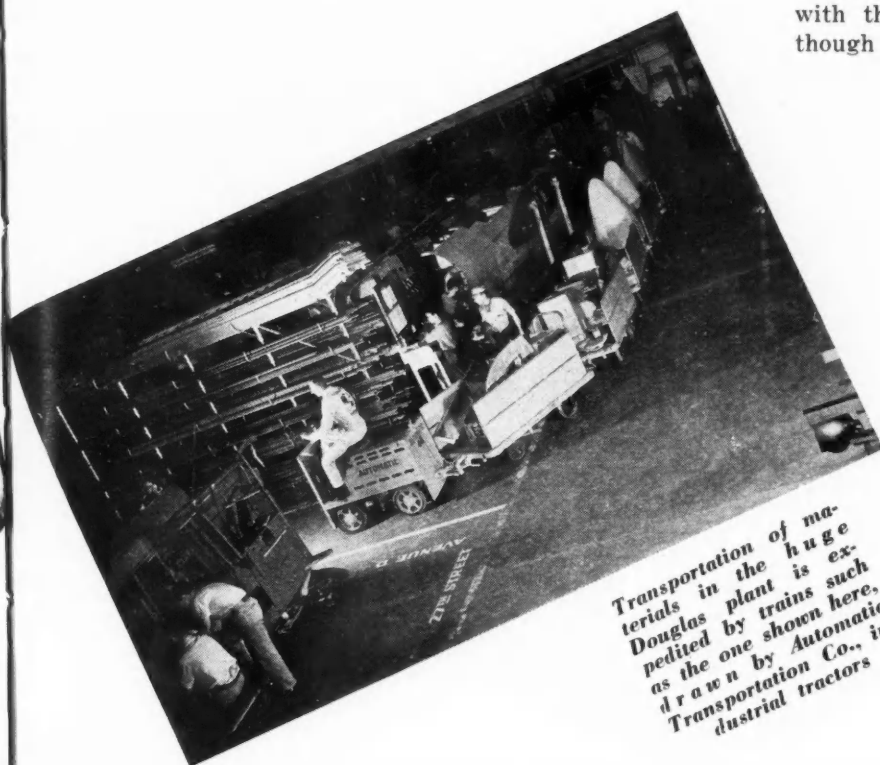
Airplane Engines

Beyond a doubt the greatest influence of automotive production methods has been felt in placing aircraft engine building on a mass-production basis. True enough, the leading engine builders in this field had had many years of experience and had established standards for materials, for surface finish, for tolerances, etc. But the translation of these standards on a volume basis was entirely a new development.

Another type of production problem was presented with the entry of in-line liquid-cooled engines. Although in detail the in-line engine is subject to the same standards of manufacturing, it has numerous peculiarities quite foreign to the building of radials. As examples of this, we may note the machining of long slender parts such as the cylinder head, crank-case sections, camshafts, crankshafts, and propeller shafts. Such parts demand special care in handling if the dimensional accuracy is to be preserved and if distortion is to be eliminated.

For one thing, it means that the number of cuts and machine set-ups must be increased. This in turn requires more machinery, more fixtures, more rigid fixtures and tooling, more massive machines.

Generally speaking, one common characteristic of all aircraft engine building is that of extremely heavy chip removal. It is common practice to find that the ratio of rough



Transportation of materials in the huge Douglas plant is expedited by trains such as the one shown here. Drawn by Automatic Transportation Co., industrial tractors

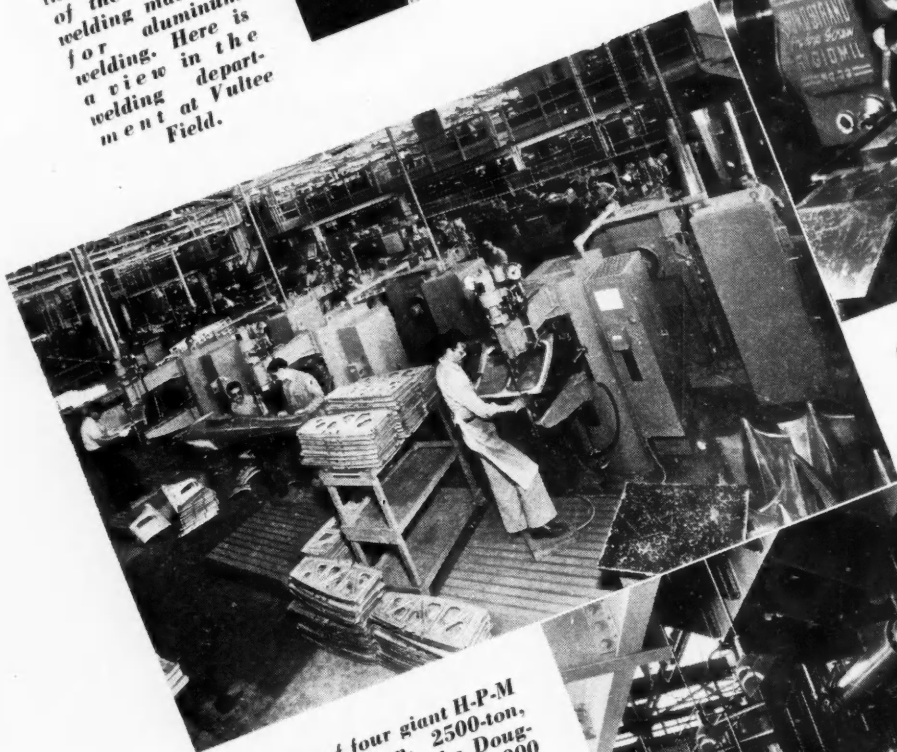


(Below) The West Coast aviation industry is the largest user of the Sciaky welding machines for aluminum welding. Here is a view in the welding department at Vultee Field.

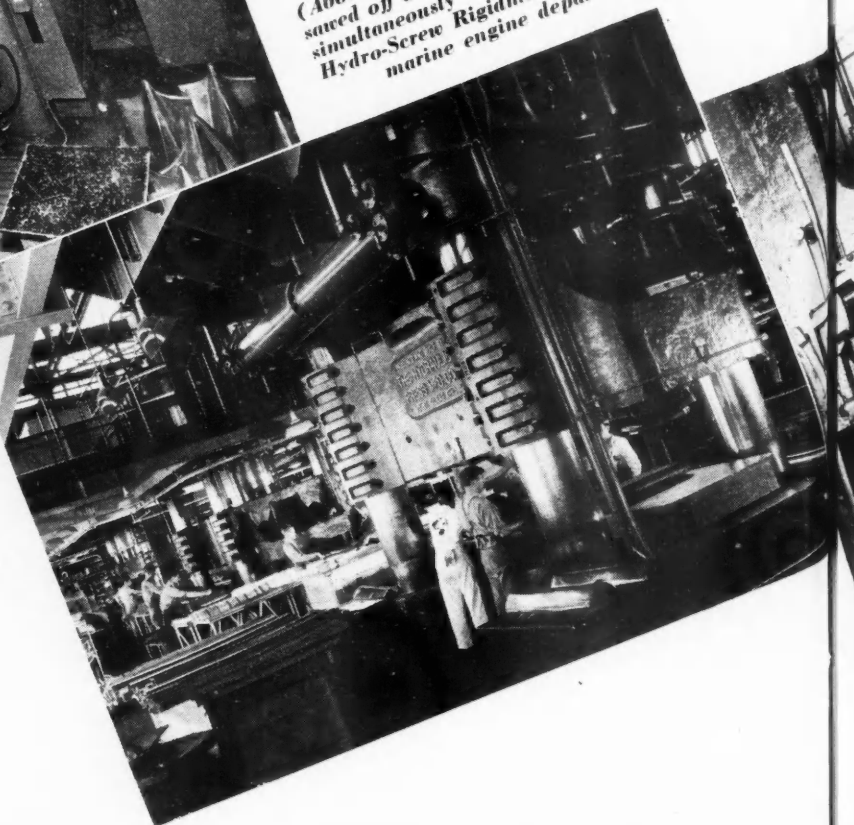
(Left) Here is a glimpse of the piston machining department in the Packard Rolls Royce plant. Along the windows at the left is a battery of Milwaukee milling machines



(Above) Connecting rod caps are saved off and con rod bolt seats milled simultaneously on this Sundstrand Hydro-Screw Rigidmil, in the Packard marine engine department



(Right) Here is a lineup of four giant H-P-M hydraulic presses of 5000-ton, 2500-ton, 650-ton, and 250-ton capacity in the Douglas plant, accounting for more than 44,000 parts every 24 hours. Feature of their operation is the use of rubber dies—the Douglas process developed by one of the Douglas executives. In the stamping and drawing of aluminum sections, a thick rubber mat lined in steel is used as the female section for a number of male die sections installed in each press



casting or rough forging weight to the finished weight is of the order of five to 1.

The manner in which automotive practice has been harnessed to aircraft engine manufacture may be outlined as follows:

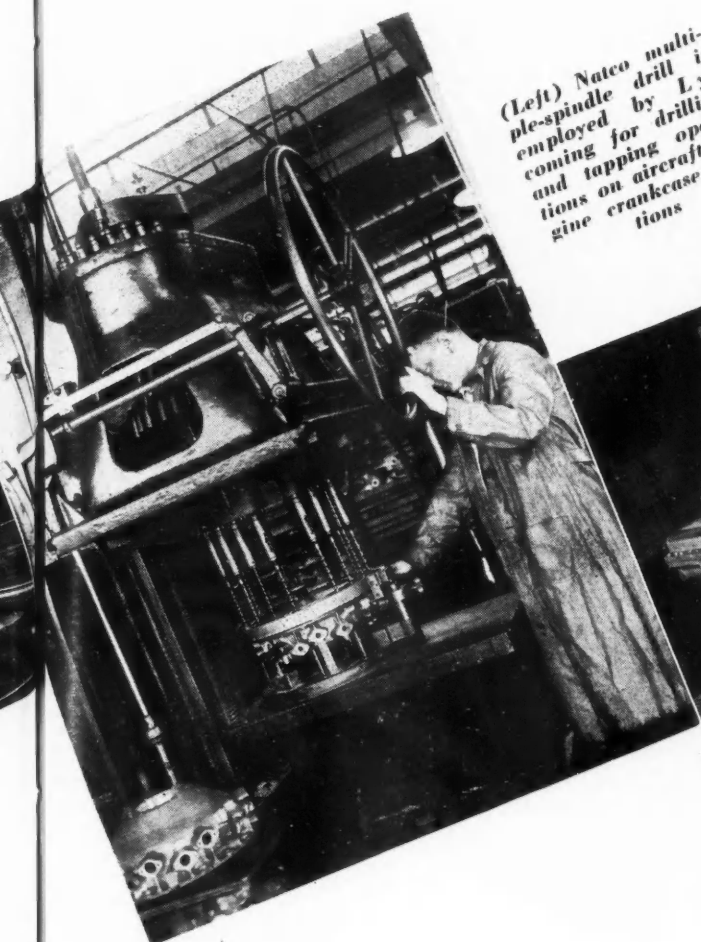
1. The use of multiple-spindle drilling and tapping and boring machines of the familiar unit-type, multiple-way design. Generally, such machines are of larger size and even more rigid than is customary on similar parts for passenger cars.
2. precision boring machines of the types made familiar by Ex-Cell-O and Heald, using cemented-carbide cutters for roughing, the diamond for finishing.
3. application of high-cycle tools for assembly operations, and portable tools for hand filing and polishing.
4. widespread application of cemented-carbide tools not only for the usual non-ferrous metal-removal jobs, but also for steel cutting.
5. general adoption of degreasing equipment which had been encouraged by the automotive industry, although the aircraft industry uses such machines much more intensively.
6. unquestionably the ability to produce fine sur-



face finishes—as fine as 1.5 micro-inches (rms)—is associated with the parallel activity in the passenger car industry, leading to the development not only of suitable equipment, but of instrumentation as well. The availability of the Magnaflex method, of the Abbott Profilometer, and of the Brush Surface Analyzer, was encouraged by the demand for such equipment in the passenger car industry.

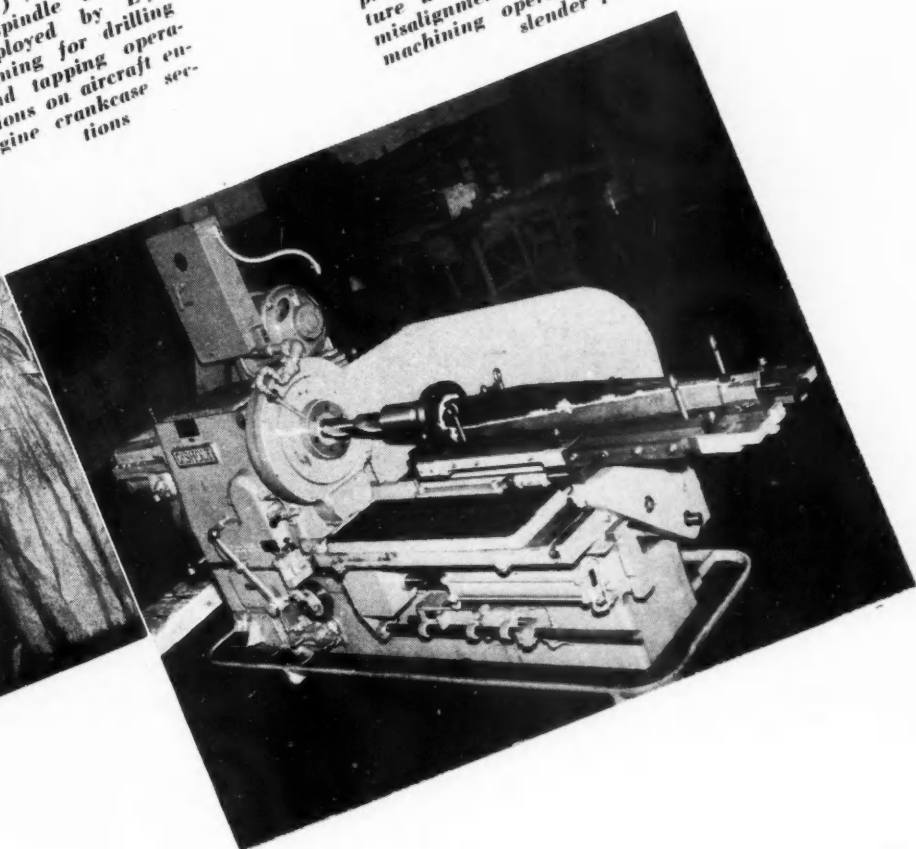
7. surface broaching, directly a product of pioneering in the passenger car field, finds a logical place as a mass production method replacing heavy milling and related metal removal operations.

8. milling machines—in this field the aircraft industry has had the advantage of the heavy-duty equipment produced by such leaders as Cincinnati, Kearney & Trecker. On the other hand, the expansion of aircraft engine production has encouraged the introduction of other types, not so familiar in passenger car practice, such as the Cincinnati Hydro-Tel automatic. Along with this are the adaptations of the Keller machines, on various parts, following a practice familiar in autobody plants for many years. An entirely new type of machine in this field is the Van Norman con-



(Left) Natco multi-spindle drill is employed by Lycoming for drilling and tapping operations on aircraft engine crankcase sections

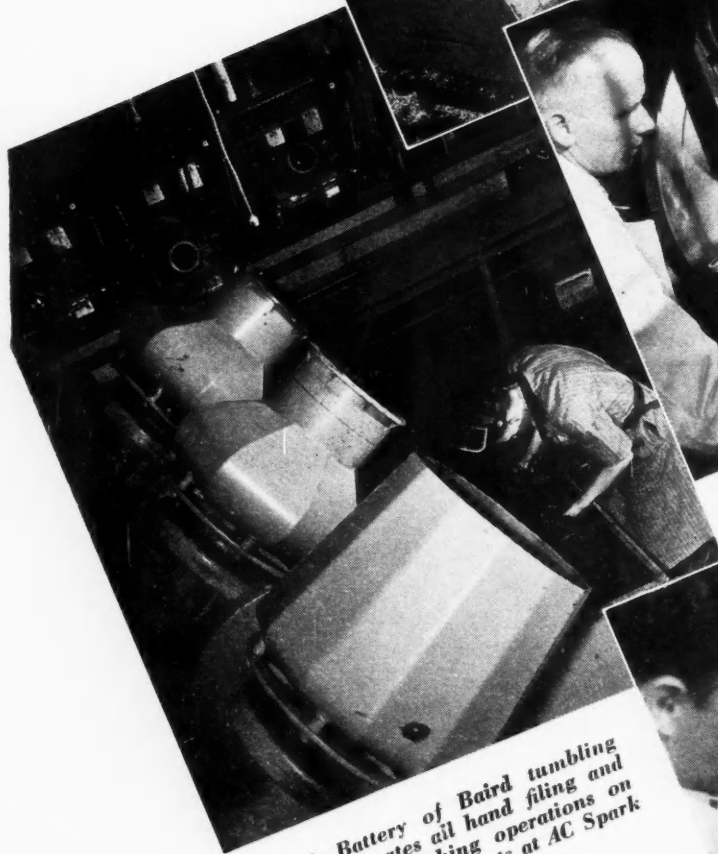
Heavy duty Gisholt lathe is used for boring operations on the Aero products propeller blade. Note the massive fixture used to assure freedom from misalignment and distortion during machining operations on this long, slender part





(Left) One of a large battery of six-spindle Ex-Cell-O precision boring machines in the Allison plant. This is an inclined head machine quite similar to the equipment developed for motor car plants a few years ago

(Below) Bryant two-spindle internal grinder is used for finishing the inside faces of the fork on the con rod cap for the Packard aviation type marine engine



(Above) Battery of Baird tumbling barrels eliminates all hand filing and burring and polishing operations on machine gun components at AC Spark Plug



(Right) Heavy-duty Cincinnati milling machine profiling the sides of radial engine con rods at Lycoming

tour miller, developed for the machining of the cam rings.

9. Grinders—crankshaft grinders, internal and external grinders, etc., are of the same types as have been used in passenger car practice. Generally speaking, however, such equipment is usually much bigger and even more rugged than conventional due to the need for exceptional rigidity, finer finish, and closer tolerances. Among the newcomers in this field are the thread grinders made by Ex-Cell-O and Jones & Lamson, spline grinders made by Fitchburg and Detroit Gear. These supplement the special grinding equipment supplied by Cincinnati, Norton, and Landis.

10. Gear practice—the advanced methods of gear finishing developed for the passenger car group during the past five years or more has stood in good stead in producing aircraft gearing in large volume. The familiar Fellows gear shapers, Gleason generators, G & E and Barber-Colman hobbers have been adopted, as have the gear shaving and lapping equipment made by Fellows, National Broach, Michigan and others. The familiar Pratt & Whitney gear grinders also are employed on large gears where grinding is necessary for the final finish.

Space does not permit of a comprehensive discussion of every aspect of aircraft engine production. However, a fairly complete picture of some outstanding op-

erations will be found by reference to files of AUTOMOTIVE INDUSTRIES for the past year in which we have covered a variety of plants such as Allison, Continental, Lycoming, Buda-Guiberson, and others.

The pictorial section gives a high-spotting of some typical operations in the plants mentioned above.

Military Airplanes

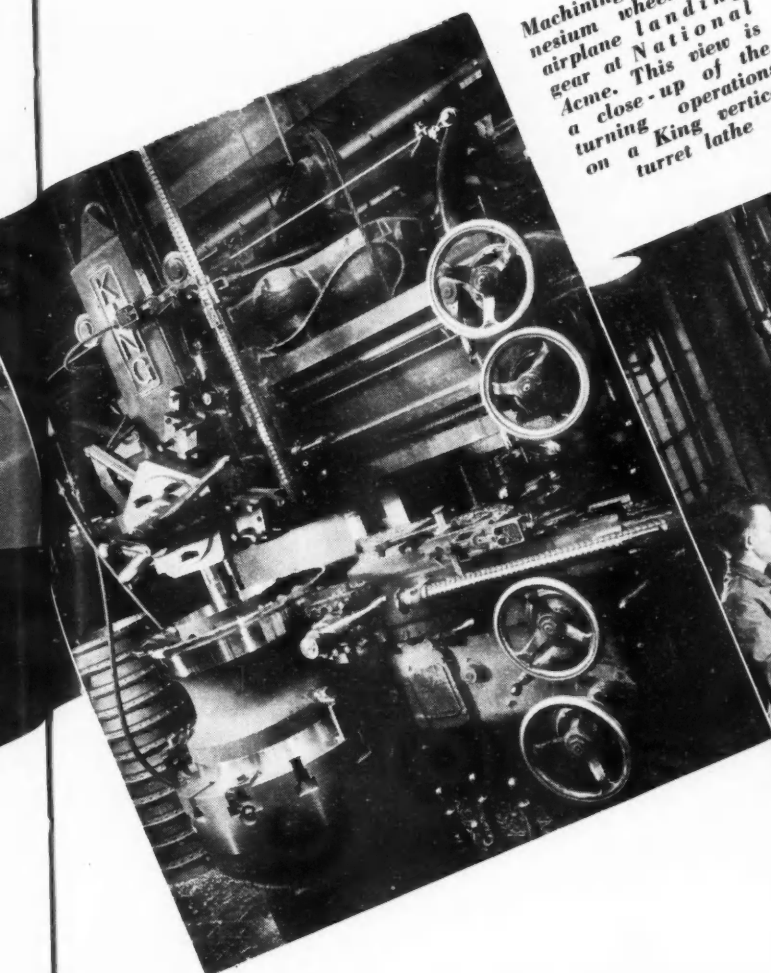
When it comes to the manufacture of airframes for fighting ships and for bombers, we approach a field which has a great deal of specialization, although here, too, major contributions are being made by the body builders of the industry—Briggs, Murray, Fisher Body, and Ford. Certainly it is patent that the autobody industry has made its major contributions in the past in the field of welding in all of its ramifications; and in the field of deep drawing with its development of heavy duty presses, advanced die design, etc.

Chief area of specialization in the aviation field, up to now, has been in the welding of aluminum and its alloys, since the welding of the stainless steel alloys was pioneered in the automobile industry from the earliest availability of these high-tensile materials.

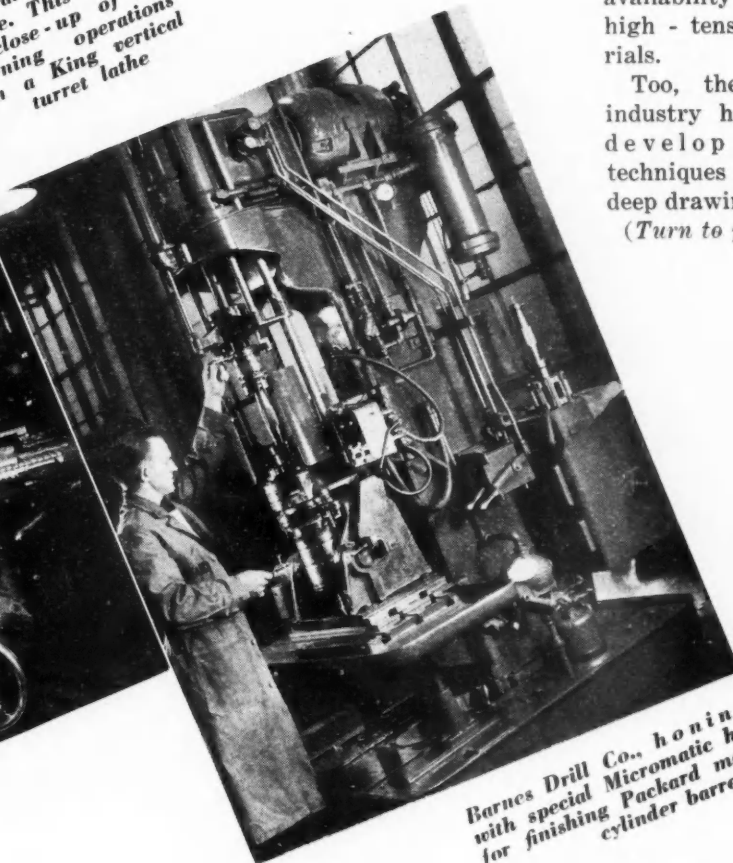
Too, the aviation industry has had to develop specialized techniques for the deep drawing of large (Turn to page 112)



Machining magnesium wheels for airplane landing gear at National Acme. This view is a close-up of the turning operations on a King turret lathe



Barnes Drill Co., honing machine with special Micromatic hone is used for finishing Packard marine engine cylinder barrels



The Industry's No. 1 Job Today is

Production for

TO SAY that the battle for democracy will be won on the assembly lines of Detroit, Flint, South Bend, Pontiac and other automobile centers may be a slight overstatement, but there is no denying that the automotive industry, its trained personnel and its vast resources are bearing an important share of the burden in making the United States a vital force for right in a world at war. From the inception of the national defense program in June, 1940, the automotive companies have pledged their talent and facilities for the utmost cooperation in making America strong. To this end more than two and a half billion dollars in defense orders have been undertaken by the industry, while more and more of its manpower and plant capacity are converted to armament work.

The automotive industry has continued to turn out passenger cars in the present emergency because of the great dependence of the nation upon mass transportation. The automobile is an integral part of the national economy and any sudden cessation of manufacturing such vehicles would have tended to disrupt civilian transportation and throw thousands of workers out of jobs before defense activities could absorb them. This would have caused needless financial hardships in hundreds of communities.

As A. P. Sloan, Jr., board chairman of General Motors, has aptly stated, "The automotive industry's most important contribution to the cause of national defense consists of management—administrative and technical. The knowledge and ability to produce the things that are needed are available, but the means to produce these things, the productive capacity—plants, machinery and the essential equipment—must be created specifically for the purpose. These are not available except to a minor degree. All of which simply reflects the limitations of the processes of mass production."

The automobile manufacturers have brought out 1942 models but many of the changes in the new cars were dictated by necessity. Priorities have played havoc with normal sources of supply, so engineering laboratories have been working overtime to develop satisfactory alternate materials. This has taxed the ingenuity of the metallurgists and engineers but they have made most of their experience and have done a fine job. Tool room capacity that would have been idle last winter, because defense production was not yet geared up to utilize it, was taken over by the automotive manufacturers to make the model changes that are now on display. Most companies had their retooling completed by late spring and there were no major

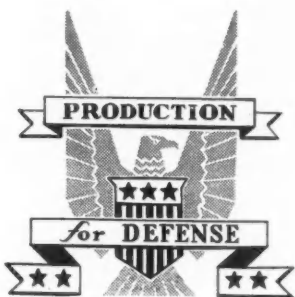
changes requiring intricate machine tools. That industry is booked solidly with defense orders.

General Motors Corp., with its huge productive capacity, leads the way with \$1,200,000,000 in defense orders, comprising about 500



Head-on view of a Dodge 4x4 at top of the 60 per cent grade with an Army officer driving and other officers riding as observers at the Chrysler Corporation Service School.

Defense



Tank beside the highway as an observer plane passes overhead. This view was taken during the Louisiana maneuvers.

different contracts being turned out by 60 plants in 35 different cities. But despite the size of its orders, this is only $4\frac{1}{2}$ per cent of total defense business placed by the Government, compared to 8 per cent of the nation's durable goods which GM has been producing. For the first six months of 1941, only 10 per cent of GM business was defense but this is gradually increasing as new plants get into operation. The corporation expects to deliver \$405,000,000 in defense goods during 1941. The program embraces 14 new plants, 13 plant expansions and the re-equipment of 26 other plants. Fifteen per cent of the corporation's more than 300,000 employees are now engaged in defense production but this, too, will increase.

Although GM is a versatile corporation doing business in many fields, 70 per cent of its defense products are outside its normal line of manufacturing activities and 90 per cent are outside the peace-time scope of the automotive industry. But the corporation possesses great executive and engineering per-

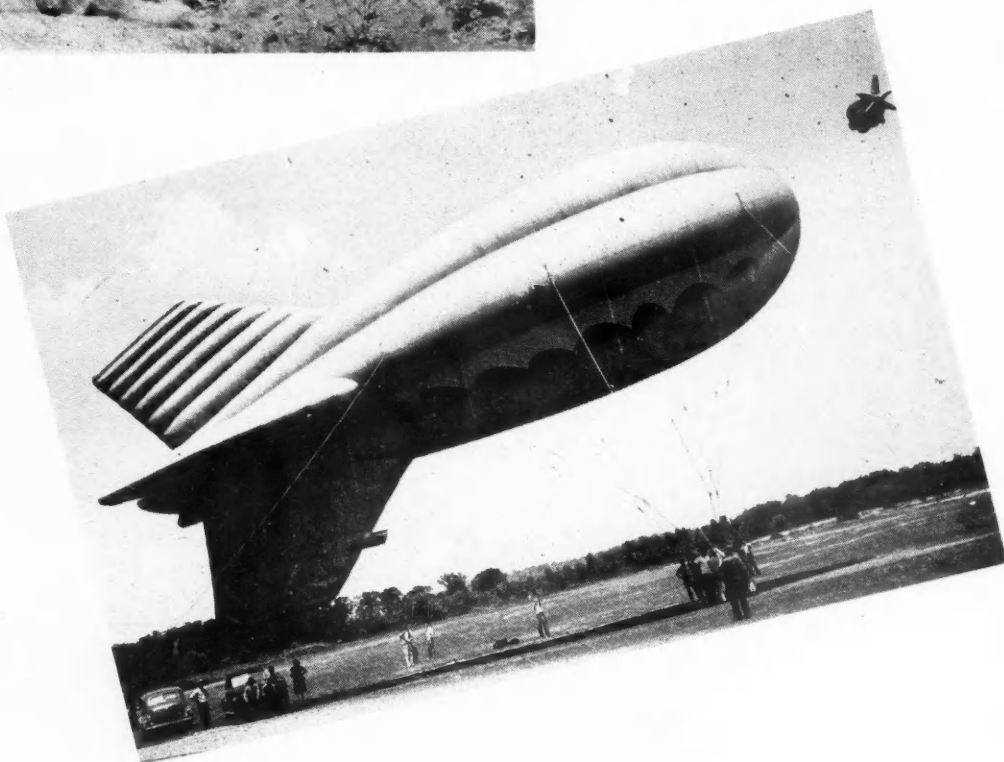
It is a circumstance fortuitous, perhaps, but fortunate, indeed, that in America, since the beginning of the century, the demand for motor transportation—land, air and water—capitalized by automotive manufacturers and supplemented by their enterprise, ingenuity and courage, has resulted in the development of a huge, specialized industry uniquely adapted to our present pressing needs. As things have turned out, our national security rests today largely on the proved ability of the automotive industry to accomplish what it undertakes. And now it has undertaken and is engaged, without hesitation or stint, in Production for Defense.

Within the limits of this article, or even of this issue, it is impossible to cite specifically the accomplishments and contributions of all of thousands of automotive plants that are devoting their time, skill and material resources to the task of rearming the United States. Virtually all are doing their parts, some at perilous sacrifices. But by their effort and cooperation they hope to continue the American way of life so that free enterprise may flourish again when the present emergency is over.



Reaching the scene of encounter a squad of cavalymen from a new Bantam car platoon dashes into action while the car skids to a stop in the Louisiana dust.

Four-lobe, four-fin barrage balloon fully inflated and ready for ascent is shown just after being removed from the Goodyear hangar at Akron. Flying from its cable at upper right is Strato-Sentinel barrage balloon, capable of ascent to 15,000 feet.



sonnel that understands and has the know-how of mass production technique, and this is invaluable in providing the armed forces of the nation not only with superior weapons and equipment, but providing it in a hurry. An organization like GM is set up so it can take care of subcontracting more quickly and efficiently than the procurement sections of the Army and Navy, which have had to expand so rapidly in the current emergency.

General Motors' principal defense orders are divided as follows: Airplane engines, propellers and parts, \$626,500,000; guns, shells and other ordnance items, \$204,900,000; diesel engines, \$159,700,000; trucks and transport equipment, \$82,300,000, and Canadian plants, \$108,500,000. In addition, Yellow Truck & Coach Mfg. Co., in which GM holds a majority interest, has received \$183,000,000 in Army truck orders.

Buick Division, which will build Pratt & Whitney radial aircraft engines at a new plant nearing completion at Melrose Park, Ill., has developed new automatic engine testing equipment that saves 3 hr. per engine. This simplified equipment, utilizing specially developed electrical, fuel, oil, air and exhaust connections, enabled Buick engineers to cut the time required for hoisting the engine to the test stand and connecting it to 30 min. When it is considered that there will be 44 engine test houses at the Buick plant and that each engine test is divided into four phases, the time saved by these short-cut methods will be tremendous. Buick will subcontract 362 parts for the engine among 46 companies in 36 cities. Chevrolet, which also will

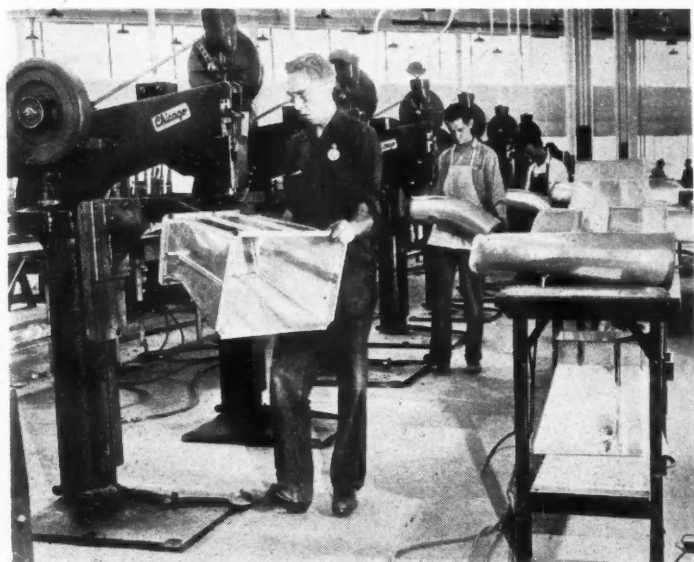
produce Pratt & Whitney aircraft engines, shut down its automobile engine plant at North Tonawanda, N. Y., with a capacity of 65 engines per hr., in order to re-tool the plant for aircraft manufacturing.

Cadillac, which is making 250 parts for the Allison liquid-cooled aircraft engine utilized its experience in production of fine motor cars to turn out an intricate hand-built part on a mass production basis. The guide vane for the supercharger, which turns at 24,000 r.p.m., is a fine piece of alloy steel with 15 fins curving outward from the hub. Cadillac engineers achieved the finished product by putting it through 24 machine operations.

Delco-Remy Division was called upon to provide aluminum castings for Allison engines. A site was selected at Anderson, Ind., and 12 weeks later the new foundry, covering five acres, was ready to manufacture 300,000 lb. of aluminum and magnesium castings per

month. Normal construction time would have been 18 weeks. This foundry has adopted a new casting process, utilizing solid molds instead of conventional sand molds, making possible faster production and more uniform results on engine blocks and cylinder heads.

Four GM divisions are producing 30 and 50 caliber machine guns for the army on a \$90,000,000 order. To circumvent the machine tool bottleneck, AC Spark Plug Division obtained a number of ancient machines from the Government arsenal, ranging in age from 21 to 73 years, and not used since the last war. These were cleaned, reconditioned, retooled and motorized to replace the old belt drives. Automotive techniques



Automobile production methods applied to airplane parts manufacturing in the Briggs plant in Detroit. Here ducts for Boeing flying fortresses are riveted. Volume production of these ducts has just been reached by Briggs. With more than 9,000 rivets and thousands of welds, these are among the most difficult airplane parts to turn out in volume.



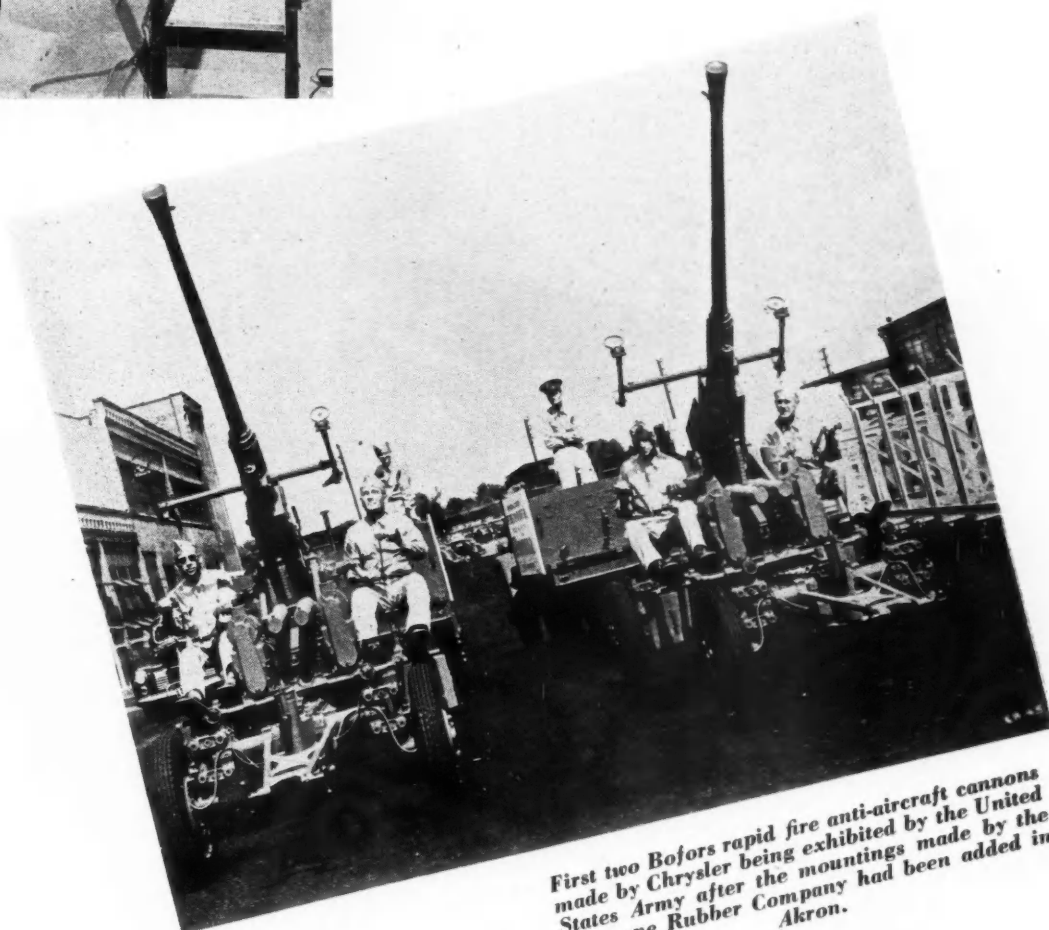
October 1, 1941

were then applied to speed the gun production. Tumbling machines were designed to eliminate 90 per cent of the laborious hand filing operations on the 285 gun parts. A special machine was built to drill six barrels at once, superceding the slow horizontal drill.

Rifling of the barrels was reduced to one-thirtieth of the former time by perfecting a broaching machine that would do in two operations what formerly required 15 trips of the chiseling tool through each of four spiral channels in the barrel. This enabled 20 to 40 barrels to be rifled in an hour instead of only 1. Firing pins were turned out like automotive valve stems, while rivets, formerly produced by turning down bar stock with screw machines, were put on a quantity basis of 180 per min. through use of a header machine handling rod stock. Twenty-two of the gun parts are supplied by 19 subcontractors. As a result of the adoption of these efficient methods, the first gun was delivered in April, 1941, eight months ahead of schedule.

But this rapid production did not come too easy. At the Saginaw Steering Gear plant, draftsmen and designers put in 62,000 man-hr. turning out 8000 tool drawings, while more than 231,000 man-hr. were expended in making tools, fixtures and gages before manufacturing operations on the machine guns could begin.

Oldsmobile, producing 75 and 105 mm. shells, uses an up-to-date 7500-ft. monorail conveyor to speed its manufacturing methods at the forge plant in Lansing.



First two Bofors rapid fire anti-aircraft cannons made by Chrysler being exhibited by the United States Army after the mountings made by the Firestone Rubber Company had been added in Akron.

Chips from the upset operations, 80 tons a day, are removed efficiently by an underfloor conveyor for reclamation. Oldsmobile employs 43 subcontractors who perform 400 machine operations in producing 121 parts for the 20-mm. Hispano-Suiza aircraft cannon which the division assembles. This is chiefly a procurement and assembly job, as only four of the gun parts are made by Oldsmobile.

Pontiac, which is preparing to produce the Oerlikon 20-mm. rapid fire anti-aircraft cannon, drew on its automotive experience to reduce the time of the broaching operation on the gun barrel from 3 hr. to 25 min. Pontiac will subcontract 141 of the gun parts among 50 companies and approximately 60 per cent of the dollar volume on the order will go to subcontractors.

Fisher Body Division will employ some of its automotive presses to manufacture airframe parts for the North American B-25 bomber. Angle plates and height boxes also have been adapted from automobile body making practice for use in airframe fabrication. The Ternstedt Division, maker of automotive hardware, is producing 306 die-cast aluminum and magnesium alloy parts for airframes.

In manufacturing gun breech housings, a Fisher plant in Detroit was able to utilize its existing facilities in turning them out in approximately four months' time. With machine tools so difficult to get, much time was

saved by the ingenuity of the body makers in using machinery and tools available. It also obviated any disruption in plant layout and the machinists did not have to master any new techniques, as they were using the old machinery. However, the complete equipment of this tool and die machine shop was a major factor in its quick conversion to the armament job.

The Grand Rapids Stamping plant is helping relieve a shortage in planers by manufacturing these huge machine tools at a rate of better than 12 a month, producing 125 of them in 10 months' time. These were requested by the OPM to speed the machine tool program. Ordinarily this type planer, with its 43-ft. center bed, requires 10 months to build.

Ford Motor Co., a master of mass production efficiency, has \$750,000,000 in defense orders on the books and is heavily engaged in the Army Air Corps' bomber procurement program. A high-speed conveyor line and elaborate test cells that provide most complete readings are two features of the new airplane engine plant at the Rouge, which is getting into production on 2000-hp. Pratt & Whitney radial engines. One Ford improvement, since adopted by Pratt & Whitney engineers, has been the use of flexible rubber brackets to

Officers from Fort Lewis, Wash., in Dodge Command Reconnaissance cars about to leave camp to size up the terrain and map the strategy of large-scale Army maneuvers on the West Coast.



Cartridge case line in operation at the Guide Lamp Division, Anderson, Indiana. Groups of inspectors working beside conveyors, such as shown, inspect every cartridge case for conformity to specifications.



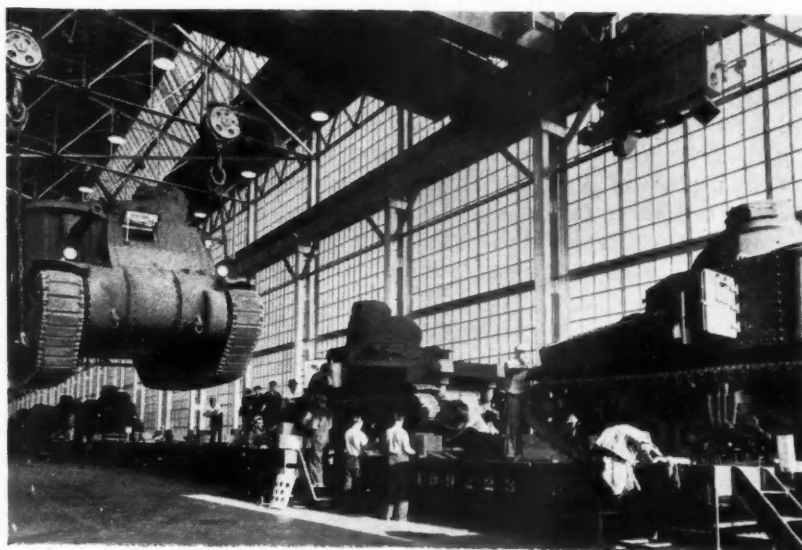
hold the connecting rods in place during assembly operations before the pistons are connected and inserted in the cylinder barrels.

Ford ingenuity also came to the fore in the use of centrifugal castings instead of forgings in manufacturing bomber landing gears, or oleos. A new steel foundry with four cupolas is under construction at the Rouge, for the centrifugal casting of aircraft engine cylinder barrels as well as oleo parts. In the oleos, the steel casting technique has reduced the number of parts and simplified the manufacture. The castings also are lighter, cheaper, faster to make and give a performance superior to that of the forgings. The centrifugal casting method was first used by Ford successfully in making automotive gear blanks.

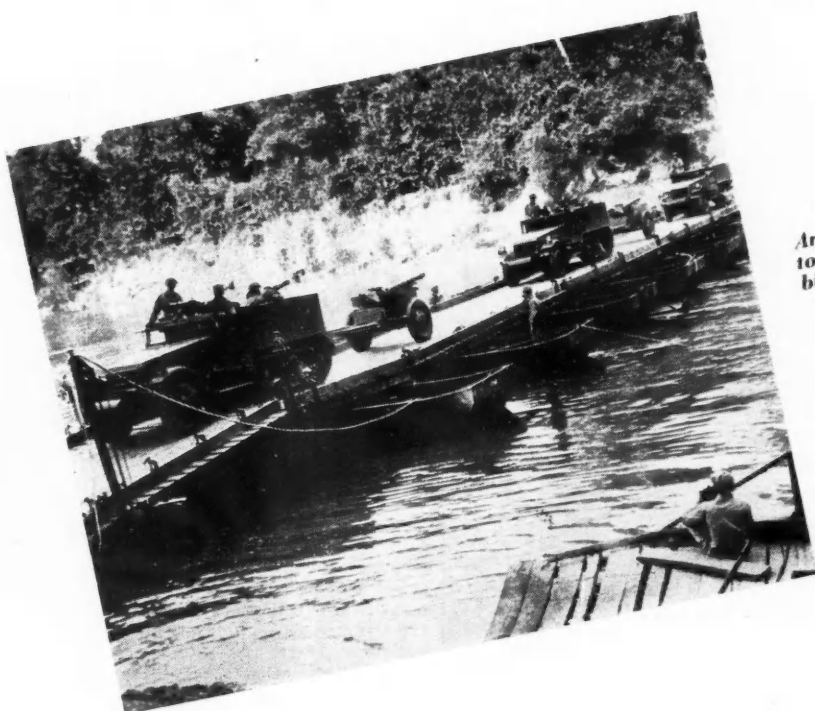
Other manufacturing shortcuts such as "gang riveting" are expected to be em-

ployed by Ford when production gets under way next spring at the vast Willow Run bomber plant, which will cover more than 58 acres and turn out over 200 Consolidated B-24D four-engine bombers per month. Ford already is subcontracting 30 per cent of the Pratt & Whitney aircraft engine production among 108 suppliers.

Chrysler Corp., with \$400,000,000 in defense orders, is supplying the Government with a variety of items ranging from 28-ton tanks and anti-aircraft guns to bomber fuselage subassemblies and army trucks. The huge Chrysler Tank Arsenal was turning out better than five tanks a day less than a year after its con-



M-3 Medium 28-ton tanks being loaded onto freight cars as Chrysler Corporation's tank arsenal swings into full production with three tank assembly lines turning out finished vehicles.



Artillery crosses a pontoon bridge over the Sabine river in Louisiana.



struction began. Even in these giant destructive vehicles, 16 times heavier than a motor car, Chrysler engineers capitalized on automotive practices in frame construction to improve their manufacture. In Government arsenals, it had been the practice to hammer hot rivets in assembling armor plate, but the nickel steel rivets lost some desirable qualities in heating and hammering. So the Chrysler technicians, in collaboration with ordnance men, adopted the automotive method of squeezing cold rivets under 100-ton hydraulic pressure. Cold rivets withstand more stress in automobile use. The tank procedure marked the first time that cold driven nickel steel rivets had been used. It was found that the frictional heat induced by the pressure improved the strength of the nickel steel. Now 98 per cent of the tank rivets are cold driven, with heated and hammered rivets used only in inaccessible places.

More than 700 companies scattered in 130 cities in 20 states furnish supplies to the Chrysler Tank Arsenal.

Chrysler anticipated its participation in the bomber program by leasing, in November, 1940, a 600,000 sq. ft. section of the old Graham-Paige plant in Dearborn. Five months elapsed before Chrysler completed the preparatory work, which included 2,000,000 man-hr. of toolroom preparation, and tooling of the bomber plant began. Chrysler will build the nose and center fuselage sections of the Martin B-26 bomber. These two sections contain 11,500 separate parts and 54,000 rivets, compared to 2500 parts in a Plymouth four-door sedan. More than 500 subcontractors will serve Chrysler in its bomber parts output when the program gets under way. DeSoto Division will turn out more than 1500 stampings for the job. With Chrysler funds, the Dodge Division has built a new forge plant for aluminum alloy forgings that will supply Goodyear, Hudson and Glenn L. Martin Co., as well as Chrysler.

Chrysler engineers showed their skill in the auto-

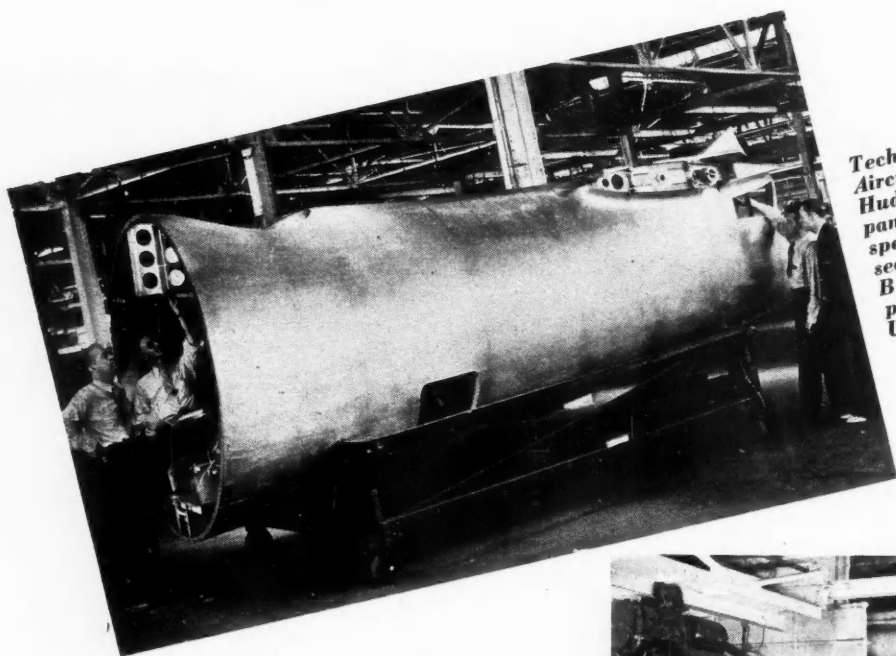
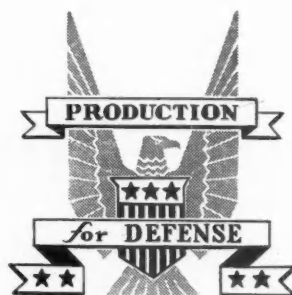
motive techniques they applied to the manufacture of the Bofors 40-mm. anti-aircraft gun, with its 500 parts ranging in size from tiny springs to the 250-lb cylinder barrel. An effort was made to reduce the 70 machine operations required to make the gun barrel from a 500-lb. piece of steel bar stock. When a change was made to lighter forgings, it was found they could be machined to close tolerances in fewer hours with less scrap and better control of grain structure in the finished part.

Plymouth Division raided its automobile production lines for milling machines that could be converted to manufacture gun parts. This enabled the corporation to push up Bofors production by nearly five months, as it takes that long to build such machines. In all, more than 400 machine tools were taken from Chrysler automobile plants for the gun job, leaving only 500 additional machines to be ordered and materially reducing the time needed to get into production. In all, nine Chrysler plants will participate in the gun production program.

To save critical materials, a switch was made from zinc-aluminum die castings to steel stampings in the production of shell clips. This will effect a saving of

engines, took advantage of its long automotive manufacturing experience, as well as its developmental work with the Liberty aircraft engine that began in the last war, to set up a plant that is expected to turn out more than 800 airplane motors per month. Starting with an order for 9000 engines, Packard had the advantage of beginning production on a large scale with a product that already had been proven, and thus was able to save time on many operations with special purpose equipment. This is in contrast to the history of most airplane engine builders, who have had a gradual development over the years and comparatively slow growth until the present emergency compelled rapid expansion of their operations. Packard employs 120 subcontractors on Rolls-Royce production.

Packard's marine engine, used to power patrol torpedo boats for the U. S. Navy, was originally developed as a racing engine for the motor boats which Gar Wood built for the Harmsworth



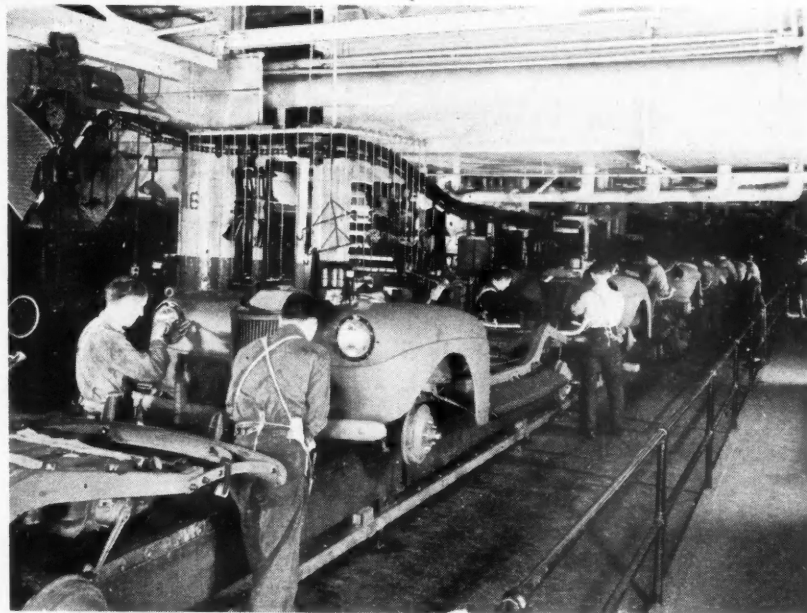
Technical experts of the Aircraft Division of the Hudson Motor Car Company are shown above inspecting the rear fuselage section of the Martin B-26 bomber which the company will build for the United States Army Air Corps.

The Ford Motor Company has already filled an order for 1,800 Army staff cars, some of which are shown here as they came off the assembly line at the Rouge plant recently. The cars are Ford Fordor Sedans. They are painted the Army's olive drab and are equipped front and rear with blackout lights.

5,000,000 lb. of critical metals on the first order. Another innovation was the application of a dynamometer testing apparatus designed for automotive engines to determine accurately the behavior of the gun's recoil mechanism.

Another not insignificant part of Chrysler's defense effort has been the delivery of more than 61,000 Dodge trucks to the Army. At present 85 per cent of the corporation's engineering research personnel is engaged on defense problems.

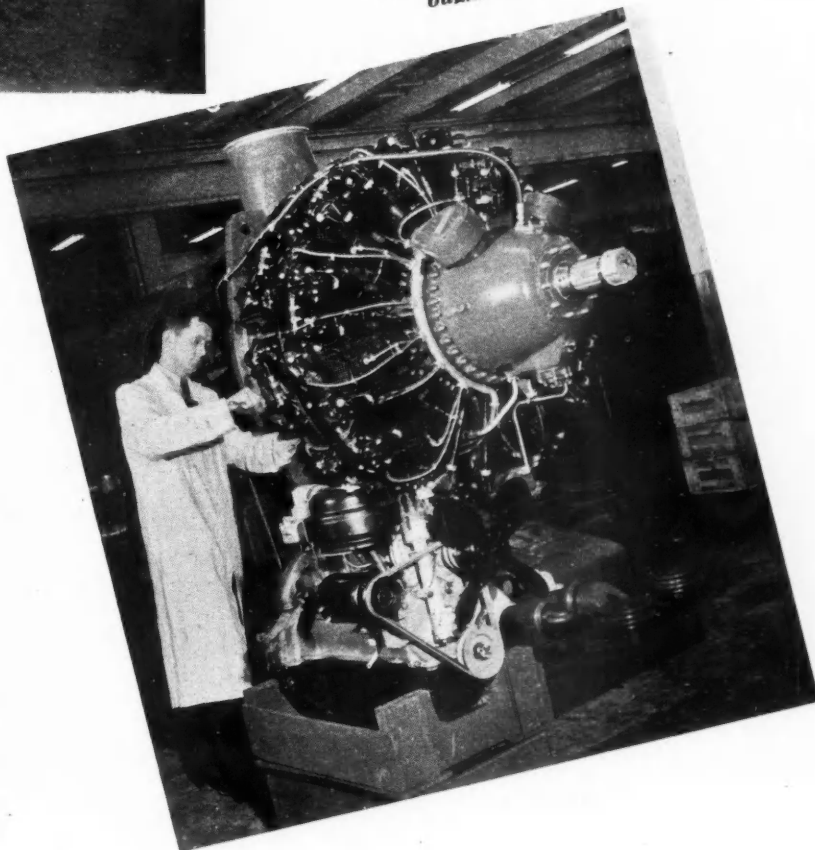
Packard Motor Car Co., which has \$250,000,000 in defense orders for Rolls-Royce Merlin aircraft engines and Packard marine





This scene in the factories of The B. F. Goodrich Company, Akron, Ohio, shows employes working on fuel tanks for combat airplanes in which rubber linings and coverings make possible the rapid sealing of holes caused by machine gun fire.

18 cylinder 2,000 H. P. Pratt & Whitney aircraft engine shown beside 4 cylinder tractor engine used in "blitz buggy". Both built by Ford.



Trophy international competition. It has been adapted to practical use in the fast Navy patrol craft.

Studebaker Corp., with more than \$100,000,000 of defense work on its books for Wright aircraft engines and military trucks, is rushing to completion three new plants for the aircraft work. A switch in the Air Corps order from 13-cylinder to 9-cylinder engines, due to change in emphasis from two-engine to four-engine bombers, temporarily slowed up tooling operations, but now the work is progressing on schedule. In an effort to speed the program, Studebaker transferred 64 machine tools from its automobile production lines to the aircraft plant, but any large scale changeover of equipment for this purpose was impossible due to the nature of aircraft engine production. Approximately 60 per cent of the aircraft engine work will be subcontracted by Studebaker.

Hudson Motor Car Co., recipient of \$120,000,000 in defense contracts, has a big project under way in the new Naval Ordnance plant, comprising 14 buildings containing nearly 23 acres of floor space on the outskirts of Detroit. This defense establishment is two-thirds completed and will manufacture Oerlikon anti-aircraft guns, torpedo tubes, gun housings and other naval ordnance. Although never previously engaged in such activity, Hudson was selected for the job of operating this arsenal due to its manufacturing experience and trained executive personnel. Hudson also has a part in the bomber program, producing the rear fuselage part for the Martin B-26 plane, to which some of its automotive presses will be adapted. The company also is serving as a major subcontractor for Wright Aeronautical Co., on aircraft engine pistons and rocker arms.

Orders totaling \$100,000,000 have been placed by the Government with Nash-Kelvinator Corp., for the manufacture of aircraft propellers and engine parts,

trailers, binoculars and bomb fuses. Due to its experience with high precision work, Nash was selected to renovate and rehabilitate two old plants formerly used by Reo at Lansing. These plants, each containing more than 450,000 sq. ft., will be tooled for aircraft work. One plant will manufacture the latest type of three-blade hydraulic propeller with its intricate operating mechanism. Production is expected to begin seven months after the date that Nash engineers began renovation of the plant.

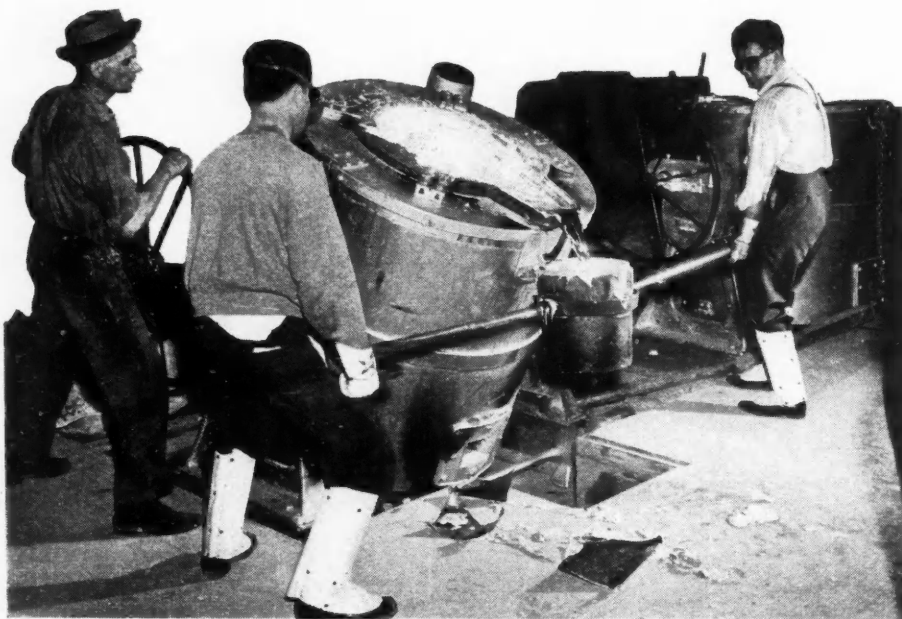
The other old Reo factory will be tooled for production of major moving parts, including rods, for 18-cylinder Pratt & Whitney radial engines. More than 100 Nash engineers have been engaged in layout and planning work at these two plants preparatory to production on a unit rather than assembly line basis.

Willys-Overland Motors, Inc., with \$39,500,000 in Government orders, is turning out a variety of items,

(Turn to page 214, please)

As to Defense Metals

How Much Do We



Workers are pouring molten aluminum into a crucible for cylinder heads of Wright Cyclone engines, but how many will be needed for defense is a question, vital to defense and to our entire economy, that still remains unanswered.

DIFFICULTIES of metal consumers and producers probably will be lightened considerably once the Supply Priorities and Allocations Board has before it detailed estimates of the needs of the Army, Navy and Lend-Lease Administration, compilation of which information was ordered in September. Until now records of capacity, production and normal industrial consumption were all that was available by way of data bearing on the ratio of supply to demand while the extent of defense requirements, the most important factor of all, was the unknown quantity. With more certainty regarding defense needs, visibility in the metal markets will be further enhanced by revision of the consumption figures in a large number of industries where the defense effort has compelled lessened activity, automobile manufacturing being the best example of this group.

In following an all-out defense program, it is necessary to cut off the civilian consumption of all metals when there is not enough to take care of military requirements. Even if a temporary condition exists in many cases, for instance in the supply of aluminum, which may be increased by next year through the addition of production facilities so that it will be pos-

sible to satisfy some of the more essential civilian demand, it usually is easier to eliminate strategically important metals in the manufacture of civilian goods by substituting some less vital

alloy than it would be to change the specifications of a defense product without impairing its efficiency.

Metal consumers are becoming more and more acclimated to the defense atmosphere, and there is little need of selling them on the basic principle of out-and-out priority for the needs of the Army, Navy and Lend-Lease Administration. Yet there are more than a few who believe that recent developments will result in disclosing before long that enough of a number of metals will be left over, after the more important defense priorities have been taken care of, to keep in operation many factories producing goods of a civilian character. The picture of metal control has undergone a number of changes since its inception and it is certain that more will follow in the future.

Pig Iron

Announcement a few weeks ago by the Iron & Steel Branch of the Office of Production Management that it had allocated the entire September production of pig iron amounting to approximately 4,500,000 tons emphasized the tightness in the supply of this basic material. Virtually all of the September output moved into defense channels. Normally about 90 per cent of the country's pig iron production is used in making

Need of This and That?

The First Question to be Answered with Regard to Availability . . .

steel. With the pressure for steel-making raw materials more intensive than ever, it is quite likely that an even greater part of the pig iron output goes to steel mills at this time, so the many complaints from foundries that they are unable to obtain adequate supplies of pig iron may be ascribed not only to keen competition by foundries for what is available, but also to the scramble for it by the steel mills. Tight as is the fit between supply and demand in the pig iron market, automotive foundries, because of the industry's abridged production program, are experiencing not a little difficulty in providing the raw material for their melts.

Scrap Iron

Kinks in the movement of scrap iron continue to be a source of grave worry to the defense authorities as well as to steel producers. Not only has speeding up of steel production brought a proportionate increase in the demand for scrap, but there was at the same time a marked shrinkage in the supply from a number of sources. One of the important gaps has been that caused by the slowing down of automobile scrapping since announcement of cuts in new car production. The scrap problem is one of long stand-

ing. That part of the supply which comes from the large steel consuming industries in the form of clippings, borings, turnings, etc., is relatively easy to control and to recover for utilization.

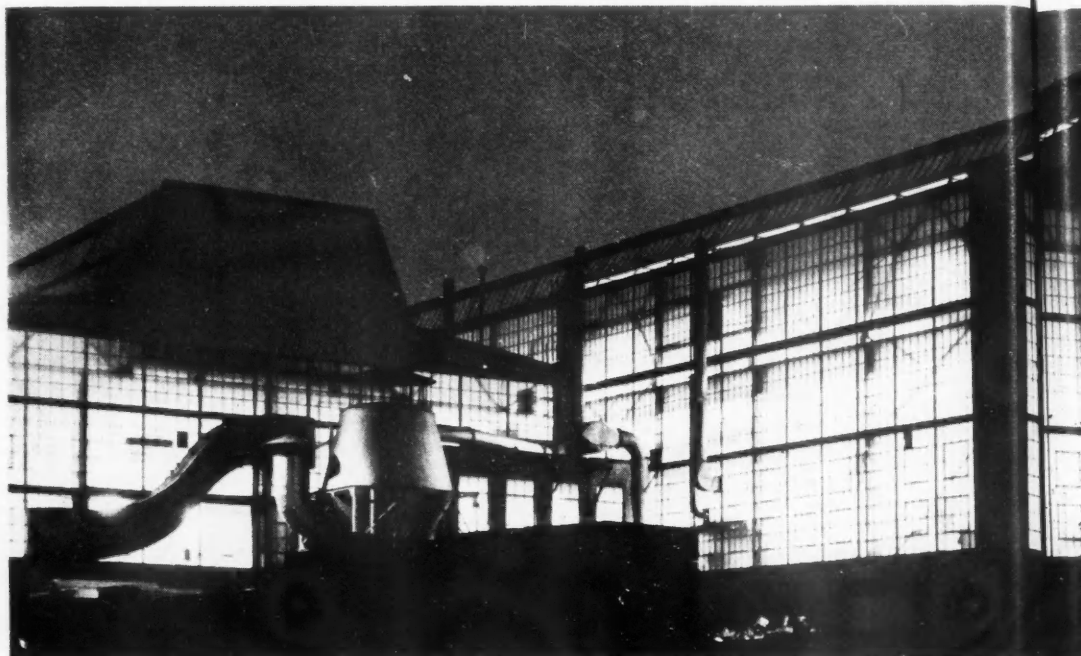
Not unlike exports in the Nation's trade balance, which have so important a bearing on our prosperity, insignificant as they may seem when compared with domestic trade, the scrap tonnage that comes from the smaller factories and shops, from the farm and from households, lighter though it may be in the aggregate than that yielded by the large industries, constitutes the marginal safety factor upon which depends to a great extent the adequacy of the supply. A good deal has been said in recent weeks regarding profiteering and hoarding attempts by some of the middlemen in the scrap trade. More important, however, is an understanding of the causes, other than human greed, that may impoverish our scrap supply not only "for the duration," but for many years to come. In normal times, the velocity at which steel returns to the scrap heap after having performed its allotted life service can be estimated fairly close to the realities, but there isn't any one today who would hazard even a wild guess as

(Turn to page 90, please)



Increasing steel production against a shrinkage in scrap supply presents a grave problem. Curtailment of civilian products, overseas shipments and how much scrap will be returned from defense materials complicate the situation.





A Look at Motor Vehicle

IT IS NOW fairly obvious that availability of critical materials will be the most important factor in determining how many cars, trucks, buses and trailers will be built during the model years of 1942.

By MARCUS AINSWORTH*

While it is true that production schedules have been established for the first five months of the model year, i. e., August through December, and it has been intimated that passenger car production for the entire model year might be cut at least 50 per cent, all of this is necessarily dependent upon whether or not there can be had the things from which to make them.

On August 21, the Office of Production Management announced that passenger car production for the four months of August, September, October and November would be cut 26½ per cent, with the expectancy of a 50 per cent curtailment for the model year ending July 21, 1942. At the same time it was announced that the increased needs for truck transportation would require an additional 200,000 units for the 1942 model year over the 1941 year. On September 15, OPM announced that passenger car production in December would be curtailed 48.4 per cent from December of last year, and that light truck production for the period August through November would be cut 9 per cent under the same period of last year. A 50 per cent cut in passenger cars will bring their production down to about 2,130,000 units. The increase granted trucks, buses and commercial trailers will bring them up to about 1,189,000, furnishing a contemplated total production of 3,319,000 units.

A 3,300,000 model year is a goodly amount of pro-

duction and not to be sneezed at, as the saying goes, United States production during the 1939 model year amounted to 3,315,647 motor vehicles, and during that year many makers showed substantial profits at the end of the year. Manufacturers, dealers and automotive distributors throughout the country were well pleased with the job they had done. This amount of production is far in excess of the output of 1938, 1935, 1934, 1933, 1932, 1931, and approximates the production of 1930 when 3,355,986 vehicles came off the assembly lines of the United States plants.

Through the ingenuity of automotive engineers a multitude of alternate materials have been put into use which will lower the consumption of strategic metals to a very marked degree. A 20 per cent cut in passenger car manufacture for the 1942 model year would have saved over one-half billion pounds of strategic and critical metals, according to individual estimates made by the car manufacturers. (A.M.A.) The contemplated 50 per cent cut in passenger car production would more than double those savings. Of this tremendous total approximately 400,000,000 pounds would have been released from civilian passenger car production alone, and, even with meeting the army specifications, over 100,000,000 pounds would have been released from motor truck production. In the passenger car total are: 118,000,000 pounds of zinc; more than 20,000,000 pounds of aluminum, 11,000,000 pounds of nickel, 1,667,000 pounds of chromium, 31,000,000 pounds of copper, 25,000,000 pounds of lead, over 2,700,000 pounds of tin, 487,000 pounds of magnesium and 107,000 pounds of tungsten.

The table at the bottom of the facing page derived

*Statistician, AUTOMOTIVE INDUSTRIES.



Savings Effected by the Use of Alternate Materials—Savings in Man-Power Resulting from Curtailment—The Need for Replacement Parts and Maintenance Equipment.

Production Possibilities

from data published in *Automobile Facts and Figures* (A.M.A.), gives the quantities of strategic metals that hitherto have been required per year in the production of motor vehicles, bodies, parts and accessories.

From the Office of Production Management we learn that by the use of alternate materials and the elimination of critical materials in non-functional parts, for the contemplated passenger car production, based on their August 21 release, for 1942 there will be needed:

2,350,480 tons of carbon steel
301,670 ton of alloy steel
496,510 tons of gray iron
115,920 tons of malleable iron
500 tons of secondary aluminum
25,000 tons of zinc
2,600 tons of chromium
40,000 tons of copper
31,000 tons of lead
2,600 tons of tin

These figures do not include the materials needed for 1,189,000 trucks, buses and commercial trailers, nor do they include the production of the vitally necessary replacement parts, about which more is to be found later in this article.

The priority ratings established by OPM for materials for the production of trucks rated one-ton-and-a-half and over, buses and commer-

cial trailers and for replacement parts for these vehicles has been set at A-3. While this is considered a high rating and is on the same basis as railroad equipment, it must be remembered that there are twelve preferential purchasers ahead of the buyer who is operating on an A-3 rating.

It has been intimated that passenger car manufacturers might have an A-10 rating for their purchases of needed material and supplies, which means that 19 procurement agencies have claims on the suppliers of critical materials before the passenger car manufacturers.

From observations made while visiting and talking with representatives of the many automobile manufacturers, it seems more than likely that they have at the present time enough supplies on hand in both

RAW MATERIALS USED IN AUTOMOBILE INDUSTRY

	1934	1935	1936	1937	1938	1939
Steel (gross tons)	4,000,000	6,075,000	6,500,000	6,553,500	156,000	5,993,590
Iron, Malleable, tons	245,000	290,500	352,000	371,500	176,000	286,000
Iron, Gray, tons	575,470	840,000	960,000	653,000	947,920
Aluminum, tons	12,000	20,000	23,400	25,300	13,100	21,000
Copper, tons	81,000	115,000	138,000	144,300	73,400	110,000
Tin, tons	8,000	9,000	11,000	12,000	6,000	10,000
Lead, tons	184,000	200,000	217,000	214,300	191,700	228,000
Zinc, tons	44,000	74,000	69,000	75,500	43,300	76,000
Nickel, pounds	12,450,000	17,100,000	21,100,000	23,000,000	12,600,000	20,000,000

parts and material to produce at least the major portion of the present indicated schedule of 3,319,000 motor vehicles for 1942. However, in view of all the difficulties confronting the passenger car and truck manufacturers, it is our personal and private guess that total U. S. production of cars and trucks during the 1942 model year will not be in excess of 2,500,000 units. Of this estimated amount, at least 50 per cent will be trucks, buses and commercial trailers with the remainder of production being devoted to passenger cars.

In the table shown below is an approximation of the number of employees and man hours required for the production of motor vehicles, bodies and parts, from 1935 to date. Basic data for this table was supplied by the Bureau of Labor Statistics.

	Average Hours per Week	Average Number of Employees	Man-Hours per Model Year	Avg. Hours per Year per Employee
1935	34.46	403,875	737,620,052	1826
1936	37.28	445,185	866,517,392	1946
1937	37.86	501,764	988,739,648	1971
1938	31.58	373,000	622,743,368	1670
1939	34.97	364,209	661,826,868	1817
1940	36.95	419,344	806,821,496	1924
1941	40.10	503,408	1,029,437,448	2045
1942*	...	318,386*	651,100,000*	2045*

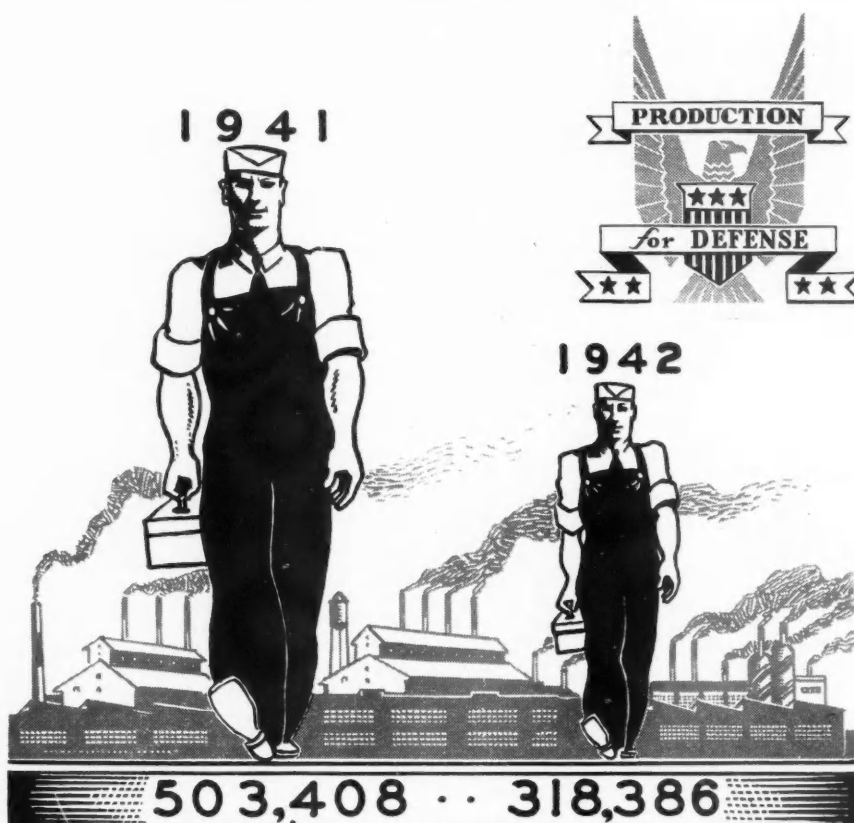
*Estimated

From this table it can be seen that 503,408 employees working 1,029,437,448 hours, were required to produce the motor vehicles, bodies and parts during the 1941 model year. It will also be noted that on the basis of the curtailed production for the 1942 model year of motor vehicles, bodies and parts it is estimated that only 318,386 employees and a total of 651,100,000 man hours will be needed, thus releasing 185,000 employees and 378,300,000 man hours for defense work.

Whatever the production for the 1942 model year turns out to be, there are approximately 32,000,000 vehicles registered throughout the United States, a high percentage of which must be kept in first class running condition. Of this number 27,500,000 are passenger cars and 4,500,000 are trucks. As to the essentiality of motor vehicle transportation, the facts are presented elsewhere in this issue. With the decline in motor vehicle production, whether it be to 3,000,000 or 2,000,000 or whatever it will prove to be, the vital necessity of preserving the motor vehicle transportation of this country increases with mounting importance. A scarcity of new vehicles simply means that present vehicles in operation must be kept in a safe operating condition for a greater period of time than has been done in the past. Already, due to urgent needs for transportation for workers in defense areas, car manufacturers

are finding out that many cars which they had considered obsolete are coming back into service and are requiring a considerable number of replacement service parts and accessories.

Information is meager as to the number of various items of service parts that will be needed to insure the safe operation of all vehicles now in use, but some conception of the size of these requirements can be secured from the following data. During 1940 the wholesale value of replacement parts and accessories amounted to \$541,268,850 which indicated that the final consumer paid in the neighborhood of \$810,000,000 for these needed parts. This wholesale value for 1940 is just double the similar value for 1933, but in that year there were 8,000,000 less vehicles on the highways of this country. It is of interest to see the fluctuation of



Man power in automobile making then and now. A comparison of the average monthly employment in automobile, body, parts and accessory manufacture in 1941 and in 1942.

requirements of replacement parts and accessories as shown in the following table:

Sales of Parts and Accessories* (Estimates based on Federal Excise Tax Receipts)

Wholesale Value	Wholesale Value
1933.....\$227,183,250	1937.....\$474,559,246
1934.....299,576,750	1938.....354,365,550
1935.....359,146,550	1939.....458,673,191
1936.....446,053,700	1940.....541,268,850

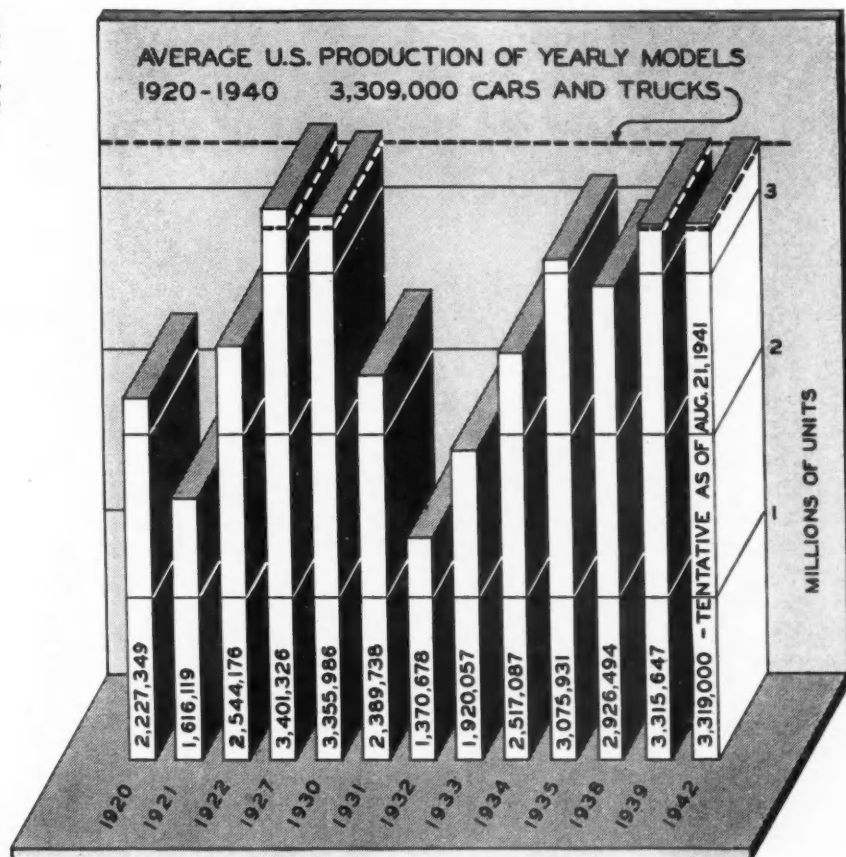
*Automobile Facts and Figures.

A further conception of the needs of the industry for replacements can be seen in the wholesale value of many of the items needed to keep the vehicles in operating condition. If absolutely necessary, a motor

Not to be sneezed at. A three million unit year rates well with the average yearly model production of the last 21 years. Yearly model production for years that were no better or a little better is shown on the chart at right.

vehicle could operate without fenders, running boards, radiator grilles, etc., but it cannot operate without batteries, generators, starters, bearings, etc. While the following figures, derived from a Chilton Company survey, are based on 1939 data, the only assured changes for 1942 would be that of a greater volume of these items would be necessary and that in 1943 a chart of these requirements would begin to climb rapidly. Only a few of the necessary items are included below.

Item	Wholesale Value
Armatures	\$3,278,000
Axle shafts	3,013,000
Batteries	18,311,000
Bearings, ball	4,364,000
Brake lining	17,209,000
Clutch disks	12,450,000
Coils, ignition	4,218,000
Gaskets, cylinder head	5,310,000
Ignition parts	14,630,000
Pistons	7,515,000
Piston rings	17,850,000
Spark plugs	15,321,000
Valves, engine	2,310,000



AN ORDER released Sept. 20 by the Priorities Division of OPM sets up a quota for the production of spare parts for passenger cars and light trucks and another order extends priority assistance in securing the material needed for the authorized amounts.

According to this new order (L-4) a producer of spare parts for passenger cars and light trucks may produce during the period from Sept. 19, 1941, to Dec. 30, 1941, 60 per cent of the number of parts sold by him for replacement purposes during the period from Jan. 1, 1941, to June 30, 1941. The Priorities Division order P-57, assigns an A-10 rating to deliveries of materials for the manufacture of listed replacement parts within the quantities established by the limitation order (L-4).

The materials needed for the manufacture of trucks over 1½-ton and the replacement parts for trucks of the same capacity take the same rating, A-3, according to recent releases from OPM.

For the next six to eight months at least, in the case of some parts producers, there may be no acute shortage of parts as indicated by a personal survey made among larger manufacturers. A representative of one of them was reasonably sure that his company could well take care of its replacement parts situation for at least six months to come and unless some unusual situation arose, for perhaps a considerably longer period of time. In order to conserve available supplies and maintain nation wide distribution of their parts, all attempts to hoard on the part of dealers or other buyers were being discouraged and suspiciously large orders for service parts were being closely scrutinized and if found to be unjustified were being turned down.

Another large producer did not appear to be greatly disturbed as regards his ability to supply parts, at least for several months to come, and was furnishing assurances to dealers that somehow or other necessary requirements would be taken care of.

However, everything possible was being done to conserve the supply. Dealer establishments were being told to "repair the part rather than replace it" wherever possible. Their stock sizes of such parts as over-size pistons were being reduced from a variety of 15 down to 3 and it was believed that, with a little extra work on the part of the dealers or independent repair shops, these three sizes of pistons would fit the requirements of those service shops.

On the other hand a supplier of a very essential component part had only one month's supply of raw material on hand and unless his source of supply was able to take care of his requirements, his company would have to stop manufacture.

Assurance is given that the Office of Production Management is fully cognizant of the tremendous importance of the replacement parts situation and the necessary shop equipment and is doing everything in its power to keep the flow of material and parts required to maintain the 32,000,000 motor vehicles now registered. However, it is not too difficult to visualize that, unless the importance and extent of the actual needs for replacement parts and maintenance equipment are correctly measured and adequately provided for, we may find ourselves in the same sorry state of affairs as the British are at present in these respects as set forth in the following article from our London correspondent.

The Breakdown of Britain's

IN GREAT BRITAIN, since the beginning of the war, the curtailment of production of civilian motor vehicles, which resulted from restrictions on critical materials, has been accompanied by the almost complete cessation of production of replacement parts. For that reason the situation in respect of supplies for existing cars and trucks has steadily deteriorated, with the result that, as stocks in the hands of manufacturers and distributors became exhausted, an increasing number of vehicles were immobilized for lack of vital parts.

The situation had become so serious by October, 1940, that a deputation informed the Minister of Transport that, with faint prospect of adequate deliveries of new vehicles, with stocks of spares totally inadequate and with facilities for repairs below the essential minimum, the road transport system of the country would break down in due course unless remedial measures were taken both swiftly and effectively. Having had no apparent effect, this warning was repeated and emphasized in January of this year and within a few days it was announced in Parliament that the Minister of Supply was "taking over the responsibility for the supply of spare parts for essential civilian road transport." As the matter, long before this, had become a question of material supplies and the coordinating of civilian and military demands upon manufacturers—for both of which the Minister of Supply is responsible—this announcement seemed to promise well for early improvement in the situation.

But a week or two later (about mid-February) it was announced that the Ministries of Supply and Transport had appointed a Motor Transport Maintenance Advisory Committee, to make recommendations on all matters affecting the sup-

ply of replacements and accessories and the facilities for the repair of civilian road transport, including premises, equipment and labor. W. E. Rootes, president of the Society of Motor Manufacturers, was made chairman of this committee, which included representatives of manufacturers, bus and truck operators, garage and repair interests and accessory manufacturers and factors. The committee had its first meeting on Feb. 21 last, but it was not until the end of June that it was divulged in Parliament that the committee, at some unspecified date, had made a number of recommendations that had been accepted and, it was said, had already been or were in course of being implemented. What the committee recommended was not then and has not since been divulged. Nor has any

benefit been observable up to the time of writing, and reports indicate that the number of immobilized vehicles is still increasing, which not only results in increasingly serious delays in essential road transport but throws heavier stress on vehicles still operating.

By October, 1940, the situation with regard to replacements for existing cars and trucks had become so serious that a deputation from the industry informed the British Minister of Transport that the road transport system of the country would break down unless remedial measures were taken both swiftly and effectively.

(British Combine Photo)



* London Correspondent of AUTOMOTIVE INDUSTRIES.

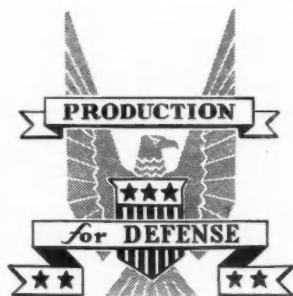
Civilian Highway Transport

Trucks are the chief class of vehicle affected seriously by this continued shortage of replacement parts, and by a similar shortage of tires that has now become evident. But how many or what proportion are lying idle on this account at any moment it is impossible to say, though as far back as May operators were reporting that in some cases the proportion had risen from 10 per cent a few months earlier to 25 per cent, and that periods of idleness due to lack of supplies had increased from a few days to as many weeks.

This shortage of replacements cannot fail to have had effect upon the servicing of cars and trucks in the export markets, for while it is usual to send with shipments of new vehicles a small percentage of spare parts most likely to be needed for them, the stocks of parts for more or less superseded models have not been replenished during the war and any shortage resulting

Don't Let It Happen Here!

In the United States, with our relatively isolated communities, our defense plants in "corn-fields," our "magnificent distances," and our definitely inadequate public transportation facilities, the need for civilian highway transport is both much more acute and much more extensive than it is in compact and closely-knit Britain. Our motor vehicles, both as personal transportation units and as commodity carriers, are essential elements of our economy and now are vital needs in our defense efforts. Keep 'em rolling!—J.C.



on this account must obviously affect the response to demands for replacements from overseas.

The Ministerial announcements bearing on matters referred to above have lately been issued. The first states that neither manufacturers nor distributors may henceforth release new or re-conditioned engines unless a permit has first been obtained from the Ministry of Supply in each case, or unless a worn unit of the same make and model is available for part-exchange.

The second announcement relates to the difficulty in obtaining new tires, and it is promised that if truck operators engaged on essential work adopt a specified procedure and provide specified information the Ministry of Transport will assist in securing the necessary tires by making appropriate arrangements with the Ministry of Supply.



In the third announcement the Ministry of Transport invites applications for purchase permits in respect of the International 6-7 ton truck chassis which are being imported on government account. It is stated that a satisfactory supply of replacement parts has been arranged for and that early deliveries of chassis can be obtained by would-be buyers to whom a permit is granted. The price asked for the chassis and driver's cab is £710.

What may represent the first evidence that the recommendations of the Motor Vehicle Maintenance Advisory Committee are being implemented, as promised, is the scheduling of motor manufacturers' repair shops under the Essential Work Order, and the offer of the Ministry of Labor to accept for scheduling the repair shops of truck operators with 20 or more vehicles in use. This means that the employees of such repair shops are held to be in "reserved occupations" and, therefore, not available for calling-up for military service. It is stated that the scheduling of repair shops belonging to truck operators with fewer than 20 vehicles is being considered, that bus operators' repair shops will be accepted for scheduling in the near future and that discussions are still taking place in regard to other motor repair shops.

Although Britain was working on a defense program prior to the outbreak of war and truck manufacturers were active on government orders, there was no curtailment of output until the declaration of war between England and Germany on Sunday, Sept. 3,

It was not until the end of June, 1941, that it was announced in Parliament that recommendations had been accepted affecting the supply of replacements and facilities for the repair of civilian road transport. Reports, however, indicate that the number of immobilized vehicles is still increasing. (International Photo)

1939. On Monday morning, Sept. 4, managements of passenger car plants issued orders that there was to be no resumption of work in certain departments, including body-building, components-assembly and machine shops. Chassis assembly and body erection were continued in some cases, but on a greatly reduced scale. Some plants even failed to open up after the week-end break.

The policy thus represented appeared to be justified by the course of events, as distributors and dealers were snowed under by

cancellations of orders from the buying public, and they, in turn, called for the holding up of shipments of new cars by manufacturers. This instant effect of the outbreak of war was due to a variety of reasons. There were anticipations on the part of the public of incomes greatly reduced, of increased income taxes having the same effect, of higher cost of living, of gasoline rationing in combination with the high rate of car taxation making non-essential motoring prohibitive in cost, and even of the total prohibition of private motoring, as during the last two years of the war of 1914-1918.

The effect upon the number of new car registrations was not so immediate, though there was a 50 per cent drop in the first month of war in comparison with September, 1938. It is probable, however, that the reduction would have been much greater but for the fact that September registrations covered a great many transactions partially completed in August. October registrations fell to less than one-fifth of those of October, 1938.

Truck production was not affected to the same extent, for although some manufacturers in this field also eased off in machine shops and components assembly,

the majority assumed—and rightly as it proved—that the government orders on which they were already working would be supplemented at once by an overwhelming demand for every type of vehicle suitable for war service. New trucks registered for civilian use had fallen to 50 per cent of normal by January, 1940, and to 25 per cent by July in that year, but these reductions may well have been due to government orders preventing the fulfillment of civilian demand.

While cancellations of orders were the general rule, a few distributors and dealers pressed for early and additional deliveries, anticipating that the war would sooner or later result in a shortage of new vehicles for civilian use, that prices would greatly increase, and that a well-stocked depot would be an increasingly valuable asset. Subsequent events proved these anticipations to be substantially correct.

With fuel rationing and the restriction of mileage it implied, large cars were found too extravagant, in fuel consumption as well as in operating cost per mile, with the results that large numbers of owners laid up their Eighteens, Twenties, Twenty-fives and Thirties and bought—or tried to buy—Eights, Tens or Twelves for war-time use. After very few months of war the demand for small cars ran ahead of production, for manufacturers were still restricting their outputs to 10-20 per cent of normal, utilizing existing stocks of raw materials and components and giving priority to export demand.

Meanwhile the Iron and Steel Control Board had been set in operation, and it had been made clear to the industry that there was little likelihood of passenger-car manufacturers obtaining further supplies when their existing stocks were exhausted. But to this rule, also, there were exceptions, and certain manufacturers were called upon by the Army, Navy and Air Force to supply large numbers of their cars, often with quite extensive modifications to make them suited to some form of specialized service. In one case—that of a prominent firm with American associations—full-scale production was resumed almost immediately, by reason of government demand for both passenger cars and trucks.

At no time during the war has there been any direct prohibition of passenger-car production, nor of trucks and buses. But curtailment has been enforced by the control of materials acquired by various departments of the Ministry of Supply. For a while in 1940 the production of cars for sale to the public, and for export, practically ceased on this account. It was

then agreed by the Ministry of Supply, in negotiations with the Society of Motor Manufacturers, that materials permitting production at the rate of approximately 10 per cent of normal should be allocated to the industry, on the understanding that the resulting output should be almost exclusively devoted to export and that the sale of new vehicles in the home market should be prohibited except to buyers holding a special permit. This prohibition applied also to all vehicles held in stock; it came into force in July, 1940, and its effect upon new car registrations is shown by the fact that during the next month, August, only 234 cars were registered in Britain, which compares with an average of 3120 in May, June and July. By January this year, the monthly total had fallen to under 200. A little later the publication of new car registrations was suspended, but it is highly improbable that the average has increased since.

As regards export trade, no figures are being issued by the Board of Trade, but it can be safely assumed that curtailment of production has affected exports adversely, beyond the falling-off in demand due to the

closure of markets in enemy-occupied countries and to various other war-born factors such as restriction of shipping facilities. Unofficial
(Turn to page 145, please)

According to a recent Ministerial announcement automobile manufacturers' repair shops have been scheduled under the Essential Work Order. An offer has been made to schedule also shops of truck fleet operators with 20 or more vehicles. Bus operators' shops will be included soon, it is promised, and other motor repair shops are now being considered.
(International Photo)





We Need Our Automobiles

AUTOMOBILE ownership, a dominating characteristic of the United States, has become a factor indispensable to the national defense.

By NIRAN BATES POPE

In every war-ridden land and among all fighting forces, from airplanes to the submarines that are their helpless prey, the present war is conspicuously automotive.

Far more obvious, yet so conspicuous as to be almost unrecognizable in terms of new specific values, is the fact that private ownership and unimpeded operation of many millions of passenger cars, on unobstructed highways all over this land, make possible immediately the manning of that Gargantuan industry creating arms, munitions and equipment for an almost unpremeditated defense.

Workers' personal transportation is, to an amazing extent self-generated, unhampered by planning, prearrangement or any sort of organization. Plants must be created, working forces organized and trained, but no matter what the location, they provide their own transportation very largely.

Moreover, the mobility and freedom of circulation retained by the population at large, through automobile ownership, is of even greater strategic value to the nation in the present emergency.

This is so because it combines with one of the prime facilities for living-as-usual, ability to liberate organized transportation for military needs, and comparative ease of adjustment to such controls as the ultimate emergency might impose.

Such advantages result not from planning for war, or from any of the social ideologies, but are the spontaneous product of industrial evolution under popular government.

The automobile is an essential part of the American defensive system because it is an essential part of the lives of the American people.

For more than a generation the attachment of the people to the land has been weakening, while diverse occupational ties have been growing stronger.

Industry and commerce in this country spring from shallow, fast-growing roots. More varied and interesting, more profitable and more promising vocations

multiply rapidly on their wide spreading branches. The American way of life is the result of going out and getting better jobs, wherever and whenever they may be found.

Free enterprise, multiplying jobs and creating new centers of work, has effected wide shifts of population; mingled peoples from widely scattered sources. Folks no longer live and die where they are born, but constantly seeking more attractive opportunities, they migrate by decades, shift their domiciles from year to year, and daily flicker about in ever widening orbits through the media of modern transportation—sometimes by wing, more often by rail, but most frequently by automobile.

Automotive industries have played perhaps the most significant part in materializing a dynamic nation out of a static, agrarian background.

The present production, distribution and servicing activities of the automotive industries—including gas and oil to transform machine potentials into mileage—give direct livelihood to 1,560,000 persons, earning almost \$2,213,000,000 in a year. Directly and indirectly, the industry supports 6,500,000 persons having an annual income of 10 billions of dollars. These are no small items in the normal national economy.

Far more importantly, the automotive industries have provided every one of the more than 26,000,000 owners of registered passenger cars with his own, independent, independently financed and operated transportation system.

It is this upgrowth, largely of the twenty years immediately following the last war, that has created in the United States a motility unique among the nations of the world, making possible an organization for national defense that is without precedent in the history of all wars.

That organization has been likened to a vast factory, in which the transportation agencies are the conveyors.

"The great precision of our mass production methods enables this national production line to extend from one end of the country to the other," commented Ralph Budd, transportation commissioner of the Office of Production Management.

In that conveyor system there will be 1,680,000 freight cars and about 5,000,000 motor trucks, by the end of this year, Commissioner Budd said.

About 25 per cent of the 4,500,000 trucks now in

More Than Ever Now

service are engaged in hauling defense goods, according to the statement of the Priorities Division of the OPM in granting A-3 preference rating for trucks of 1½ tons and over, trailers of five tons and over, and replacement parts therefor.

While throttling passenger car production, probably to less than half of last year's capacity, the Government contemplates an increase in the output of heavy trucks, by as much as 20 per cent, during the manufacturing year that has just begun.

There are about 2,650,000 medium-sized and heavy trucks on the road at present. From 10 to 50 per cent

of ordinary intercity shipments represent defense goods in transit, and as much as 85 per cent of some trucking operations represent defense activity; keeping the stream of materials, parts, goods and supplies constantly flowing from each department of the "national factory" to the next station on the line.

During the first half of 1941, nearly 22 per cent of all motor truck production was for military purposes, and an additional 14 per cent was for civilian projects specifically connected with defense. The purport of some of these activities will stand review in this connection.

Soon, the Army will have reached the goal set for its motor transport program, which requires 285,000 motor vehicles, costing nearly 50 billion dollars. This represents about one-fifth of last year's total motor

Just For Example

Percentage of Parts and Materials Hauled to Plants by Motor Trucks

(Shaded Areas Represent Percentage of Total Parts or Materials Received by Highway Transport)

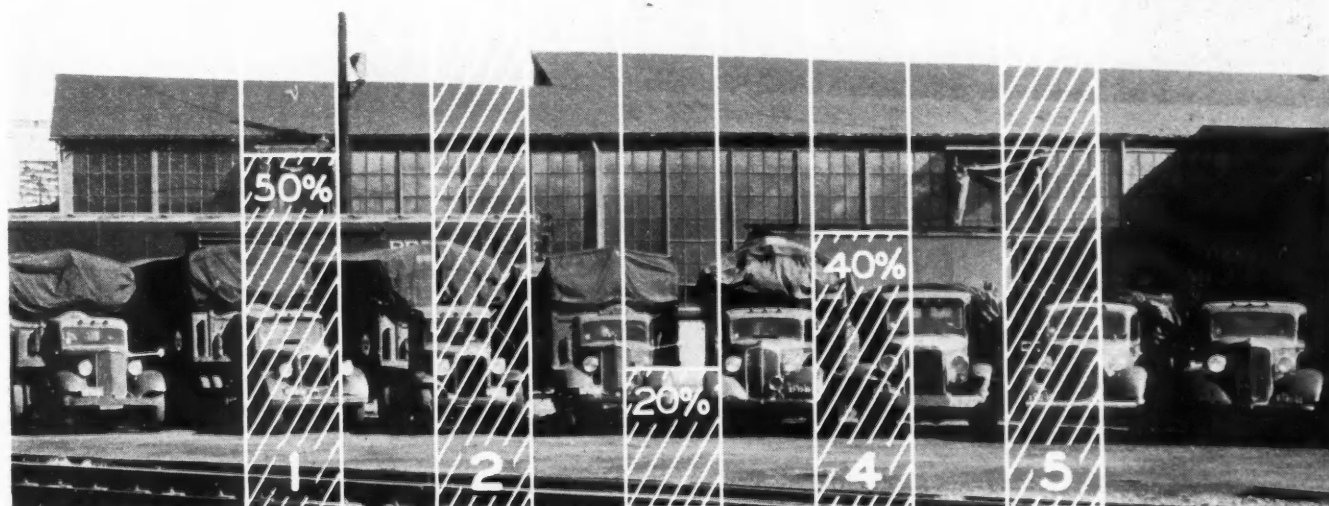
1—An Automobile Manufacturer

2—A Mid-West Aviation Parts Plant

3—A Michigan Motor Parts Plant

4—An Eastern Aircraft Engine Plant

5—Buffalo Airplane Assembly Project



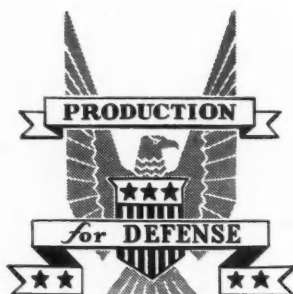
truck output.

Politically and practically the Army may be just a home guard. It represents a secondary part of the all-out defense under the lend-lease program and the policing of the high seas. Yet its most striking characteristic is mobility, and the creation of its motor transport system has been the great achievement of a very short space of time, keynoting the defense program as a whole.

Seven motor supply depots, scattered throughout the country, furnish motor supplies and spare parts. Light and heavy maintenance companies maintain vehicles and the many motorized special purpose units. Truck companies operate them. Repair shops, training schools and other facilities are systematically allocated to the points where they are needed.

Nearly one-third of an army of 1,400,000 men is engaged exclusively in providing rapid transit for the other two-thirds with their accoutrements. Approximately 400,000 men will be either drivers or mechanics attached to trucks, tanks, passenger cars or some other form of automotive equipment.

But note that in a recent movement of 10,000 troops



a distance of 900 miles, across six states in seven days, it was a civilian trucking concern that took on the job of hauling more than 210 tons of food from four Army bases located at strategic points. The particulars of such food haulage operations are interesting and eye-opening.

To visualize the Army's haulage problem in other than tactical terms, think of 100,000,000 articles of clothing and shoes, 60,000 tents, 2,000,000

sheets, 1,000,000 blankets, 400,000 comforters, 2,000,000 dishes and 2,000,000 pieces of tableware. Those quantities represent the distribution of the past year of personnel equipment into a single corps area, whose posts, in all, comprise 20,000 buildings, located in 2,450,000 acres of military reservations.

Those reservations are served by 98,000 miles of roads and 131 miles of government-owned railway trackage. Note that ratio. Almost 750 miles of roads for every mile of rail are required to feed and clothe the boys in camp.

While the motorized Army rolls along its spectacular way, motor transportation is playing a stellar role in the construction of the "national factory," whose

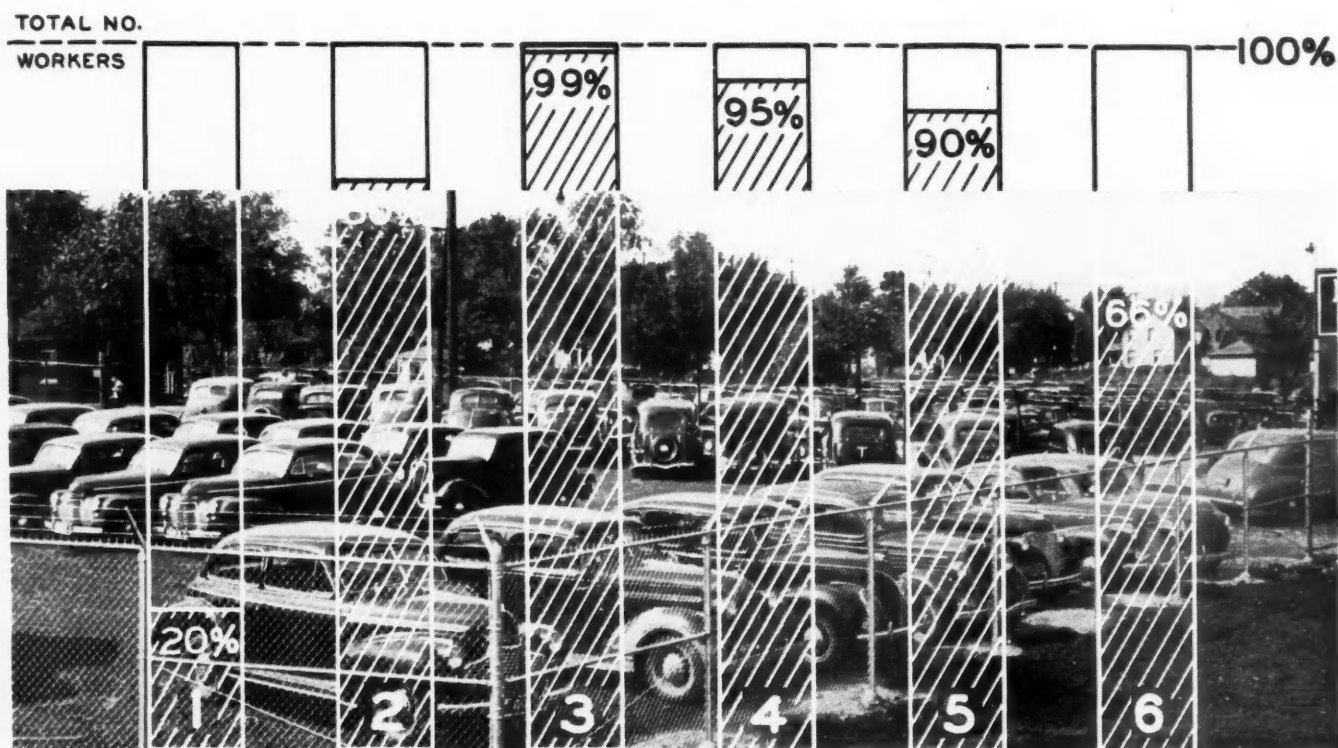
Just For Example

Percentage of Workers Who Get to Their Jobs by Automobile

(Shaded Areas Represent Percentage of Total Employees in Each Plant Who Travel to and from Work in Private Vehicles)

- 1—A Detroit Automobile Plant
- 2—A Michigan Parts Plant
- 3—A California Aviation Plant

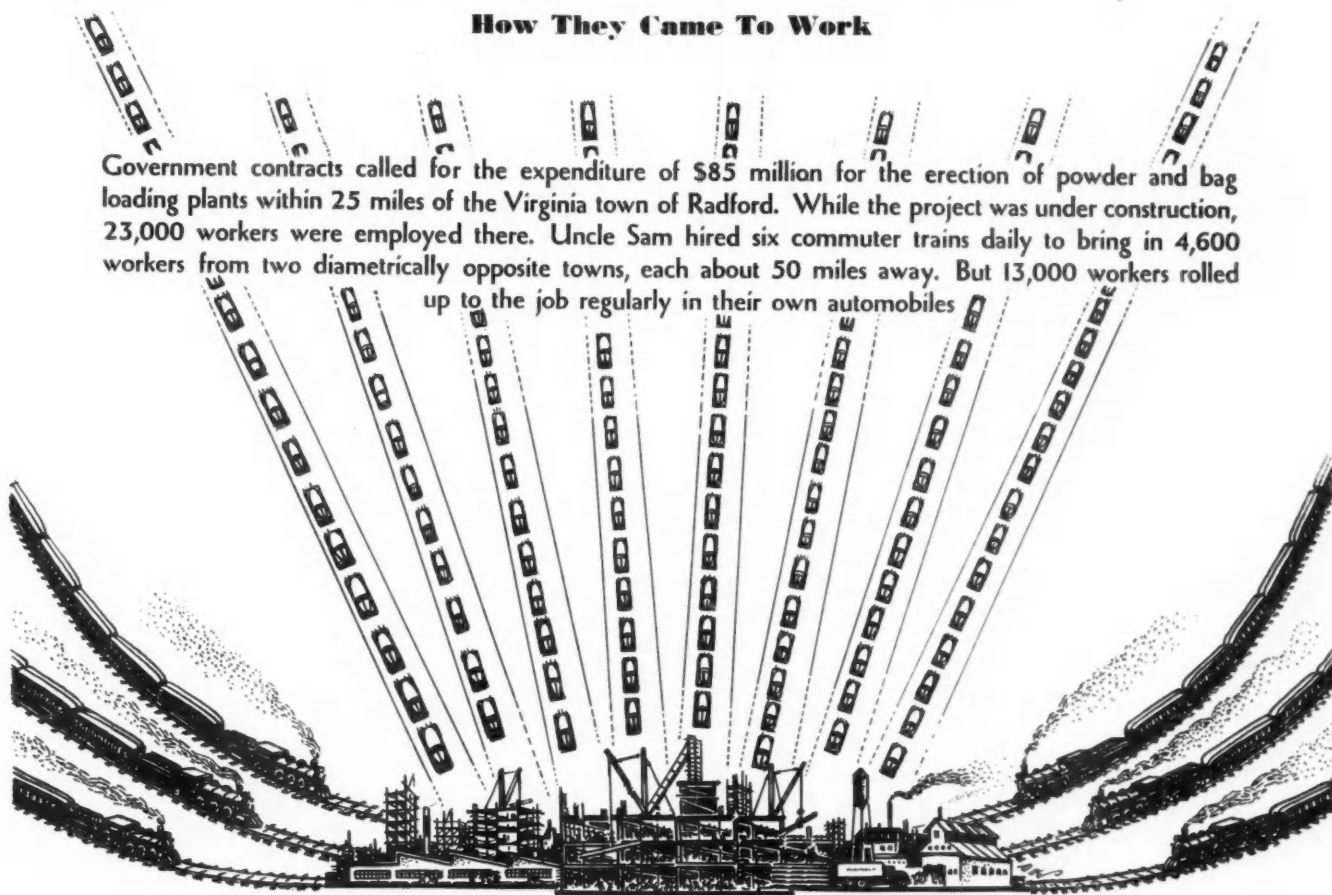
- 4—Another California Aviation Plant
- 5—A Texas Shipbuilding Plant
- 6—An Eastern Aviation Plant



What Happened Near Radford

How They Came To Work

Government contracts called for the expenditure of \$85 million for the erection of powder and bag loading plants within 25 miles of the Virginia town of Radford. While the project was under construction, 23,000 workers were employed there. Uncle Sam hired six commuter trains daily to bring in 4,600 workers from two diametrically opposite towns, each about 50 miles away. But 13,000 workers rolled up to the job regularly in their own automobiles



branches and assembly plants are multiplying rapidly, often in remote and barren locations.

For example, within 25 miles of the Virginia town of Radford, Government contracts called for the expenditure of \$85 million for the creation of powder and bag loading plants. While the project was under construction, 23,000 workers were employed there, 13,000 of them itinerants.

The town itself was able to accommodate 7500 of them. A thousand lodged on surrounding farms. The community could absorb no more. So what?

Uncle Sam hired six commuter trains daily to haul in 4600 more workers from two diametrically opposite towns, each about 50 miles away.

But 13,000 workers rolled up in their own automobiles.

That enterprise will furnish employment for 800 workers regularly; distribute \$10 million a year in wages. The Government is building 560 small houses. Real estate is booming. Automobiles are all over the place.

Similar characteristics as to personnel problems and their solutions pertain with respect to other projects in the same group, such as those at Sandusky, O. (\$18 million); Ravenna, O. (\$48 million); Burlington, Ia. (\$44 million); Wilmington, Ill. (28 million); Charleston, Ind.—a cornfield less than a year ago (\$117 million); Milan, Tenn. (\$45 million); Childersburg, Ala.

(\$58 million); Weldon Spring, Mo. (\$45 million).

At all of them motor vehicles are performing conspicuous, but natural services. Not only in the construction of the "powder towns," but in the construction and operation of many industrial plants of other types, the performance of the truck and the passenger car is a noteworthy thing.

Here, for instance, is a truck manufacturer with more than \$50 million in orders for scout cars and other Army vehicles. About 65 per cent of current output is for military uses. This concern buys supplies and parts from 186 primary suppliers and they, in turn, produce materials from 7812 secondary suppliers. All told, materials going into the final products are derived from sources in 219 different communities, located in 26 states. Delivery schedules are rigidly timed. Loadings are proportionate to the production rate. The inter-plant truck "conveyor system" thus becomes a part of the operating routine.

An automobile manufacturing company, which is also a contractor for airplane engines, receives about half of its incoming material over the highway, 50 suppliers sending in 25 to 30 truckloads every day. The longest haul is 900 miles.

A mid-western aviation parts supplier receives 90 per cent of its incoming shipments by truck, and has 100 truck units in daily service. A Michigan motor parts plant, which is more nearly self-contained, gets

20 per cent of its materials from 50 suppliers, located up to 250 miles distant from the plant. An eastern airplane engine maker receiving 40 per cent of its materials by truck, draws on 1200 suppliers, at the rate of 16 truckloads, or 650,000 lb. per day, from as far away as 500 miles.

At the other end of the scale is one of the new aviation plants which is served entirely by rail, but this is exceptional. In between the extremes are many gradations. The speed, convenience, economy of the motor truck in most instances determines the selection of method. Lack of other facilities, the time element and other factors establish preferences for truck haulage, which cannot always be accommodated.

For instance, a Government contractor on the Gulf Coast is getting about 10 per cent of its supplies by trucking service, which is inadequate. However, the Texas Railroad Commission has granted permits for two more truck lines to operate into plant territory, and relief is promised.

On the other hand, railroad service is sometimes inadequate, an "off-line" plant in New Jersey being able to get over-night service from New England by truck, whereas by rail the requirement would be three to five days.

The "inter-plant conveyor" system effects an extraordinarily close hook-up between departments in many instances.

Detroiters are familiar with the conveyance of huge loads of automobile bodies from plant to plant, on schedules so close as to admit of practically no storage at the receiving end; know too, that under proper supervision, such freight movements through the streets need not impede the normal traffic flow.

Even more spectacular is the movement of airplane parts and subassemblies in the vicinity of Buffalo, where trucks are shuttling from one plant to another in an almost endless stream, and plans are under consideration for concentrating all final assembling operations in a single plant. This would mean 100 per cent dependence on the highway conveyor link.

The strong point about motor trucks in interplant haulage, as in construction work, is that they are always ready to go to work anywhere, at any time, requiring no provision of capital for organization and no special construction.

The same is true of the worker and his automobile.

The wage earner's passenger car is no novelty. It is the principal factor underlying used car demand, and along with the ruralist's private car it heavily weights the nation's automobile statistics.

So much so that the American Petroleum Institute finds "the typical American motorist" to have an income of \$20 to \$30 a week, to drive about 8500 miles a year in a closed car that is four to five years old and worth about \$225, ride as to 90 per cent of his trips, not more than 30 miles from home—and pay almost \$56 a year in automobile taxes.

It is this "typical American motorist" who accounts

for the congestion of parked cars in all the villages and towns scattered throughout the countryside, and it is he whose not so bad looking automobile is parked adjoining the industrial plant where he works—sometimes requiring an area for parking almost as great as that of the plant itself. Ford's new \$27,000,000 Pratt & Whitney engine plant site, in fact, was a parking lot for employees, less than a year ago!

In the older industrial centers, where land is at a premium and employees are forced to come to work by trolley or bus, the situation is not always entirely a happy one. Consequently, on the outskirts of industrial cities, where factory employees have opportunity to express their preferences, the number of parked cars is greatly increased.

One of the automobile plants on the outskirts of Detroit parks nearly 3000 cars daily, accounting for about one-fifth of the total number of employees. A parts maker in another Michigan manufacturing center, finds that 1800 to 2000 workers, or 75 to 80 per cent of the force, drive to work.

A recent survey of 834 cars at this plant revealed 17 different makes of automobiles, including all price classes, dated from one 1942 model back to a car built in 1927. Of these cars, about 45 per cent were of ages up to but under four years; 35 per cent were from four to six years old; about 20 per cent were six years old or older.

A tabulation by ages closely parallels the recent study by AUTOMOTIVE INDUSTRIES of the ages of all cars in use, suggesting broadly that the workers' cars represent a fair cross-section of traffic, as you see it on the road.

Many of the new defense plants have a much higher proportion of workers' personal transportation than do many of the older industries. Many of them are without public service facilities, or are served by bus lines which are incapable of handling the daily traffic burden.

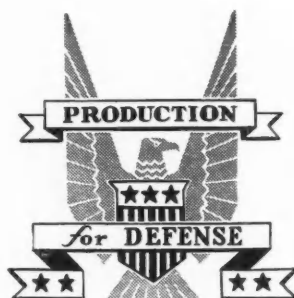
At one of the big aviation plants in California 25,700 people go to work in 8500 cars every day, whereas only 300 come in by bus. By next January, the same management will be operating four plants, with a total estimated force of 65,000, and it is expected that practically all the workers in these four plants will furnish their own transportation.

Ninety-five per cent of the workers in another California plant drive to work habitually, using approximately 3500 cars.

Ninety per cent of the employees at a new shipbuilding plant in Texas now come to work in private passenger cars, and it is estimated that the 1800 people, now arriving and departing daily in 800 cars represent about one-third of the full-time force, and one-third of the peak in parked automobiles.

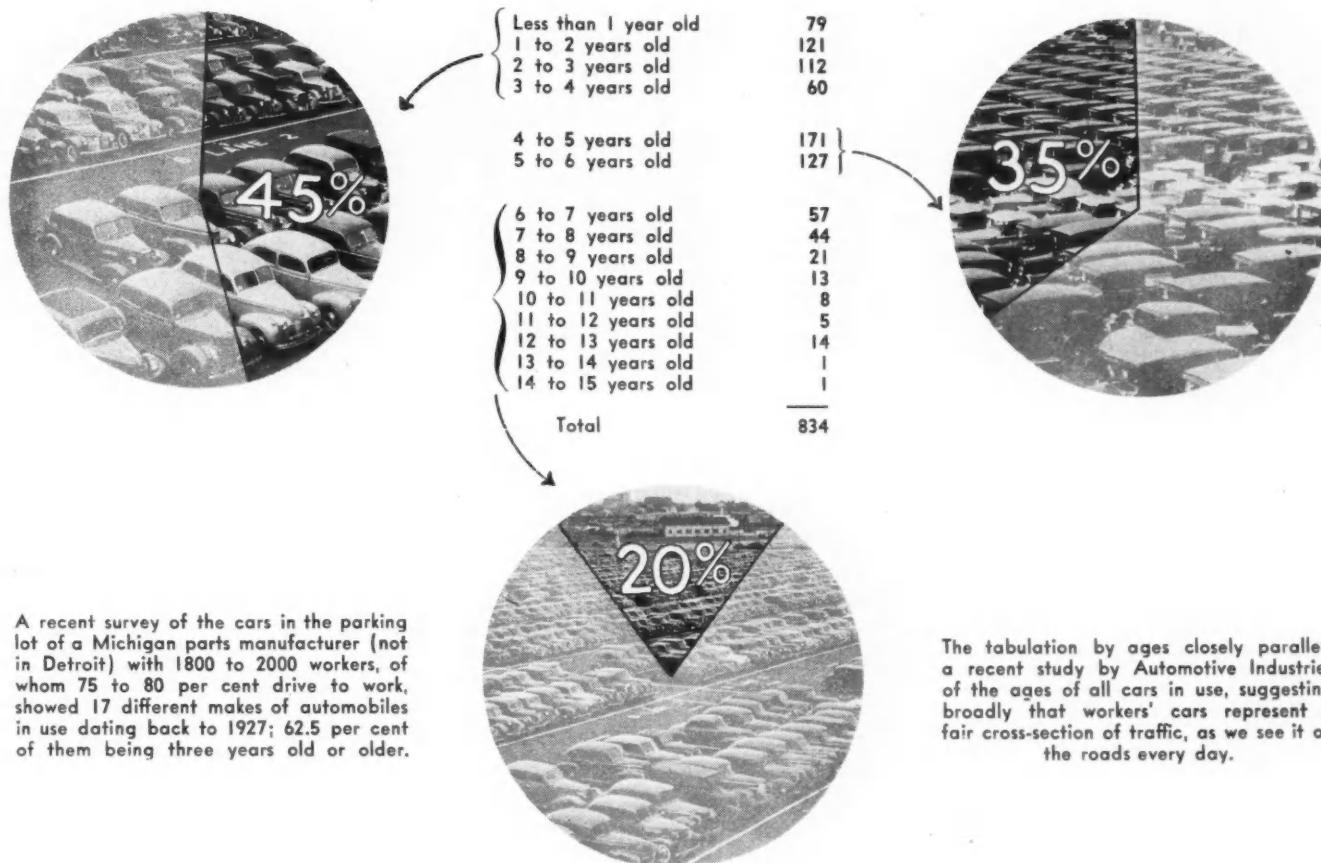
An eastern aviation plant, which is situated in a metropolitan location, nevertheless, parks 10,000 cars a day, bringing in 12,000 riders on the time clocks, or two-thirds of the entire working force.

Statistics are valueless in the present expanding



Ages of Cars Used by Workers to Get to Their Jobs

A Case that is Typical



condition of the "national factory," but such illustrative figures as have been given could be multiplied indefinitely and in endless variety.

Personnel directors confess their inability to forecast what proportion of a newly organized or expanded force will drive to work, but remark the frequent necessity of increasing plant parking areas.

Footnotes to these and other observations. Mothers, wives and sisters often jitney workers to and from their jobs in the family car, which may never be parked at the plant at all. Also, joint ownership and share-expense arrangements are common, while neighbors, working at the same plant, often use their own cars on alternate days or weeks, always leaving one car behind for family use.

No "law" is involved in automobile usage anywhere, but it all adds up to a perfect demonstration of the assimilation of the automobile in the American scheme of things.

In its recent "Factual Survey of Automobile Usage" the Automobile Manufacturers Association showed that driving to work and using the car on the job normally accounts for roughly one-half of all automobile usage in the United States.

Nearly 25 million passenger cars are customarily driven for purposes connected with earning a livelihood, or closely related economic pursuits.

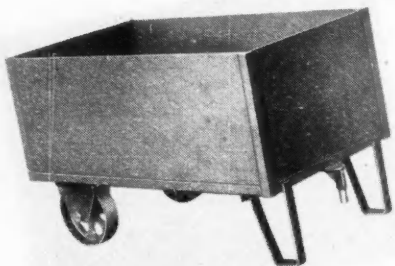
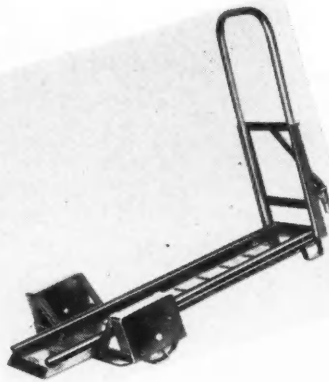
Only a mere 4 per cent of the 26 million passenger cars in use are "pleasure cars."

On the other hand, more than 11 billion round trips are made each year for what are broadly classified as "business reasons," and these account for 274 billion passenger miles of travel, equivalent to almost three and one-half times the total passenger mileage of all other forms of transportation.

Still another side of the automobile utility question is its daily service to millions of homes.

"Motor-driven vehicles bring milk and newspapers to our doorsteps in the early morning," (Maj. Edward Bowes is broadcasting now) . . . "they take more than three and one-half million children to and from school each day . . . they rush fruit and vegetables, eggs and many other perishables from orchard and farm to our markets, and, from there, to our stores and homes . . . they transport a vast and rapidly growing number of passengers over our city, inter-urban and trans-continental bus routes . . . day and night they are moving millions of tons of crops and raw materials from our farms, woods, mines and quarries, and the products of our mills and factories, over the broad highways of America, and they do this tremendous job with an efficiency and economy that cannot be equalled in the whole realm of commercial transportation."

(Turn to page 122, please)



Various types of trucks are built for use with the Clark lift jack, manufactured by the All Steel Welded Truck Corp., Rockford, Ill. Here are shown the jack and three of the trucks. Two are the bin and cylindrical tank types. The third is for hauling wire coils.

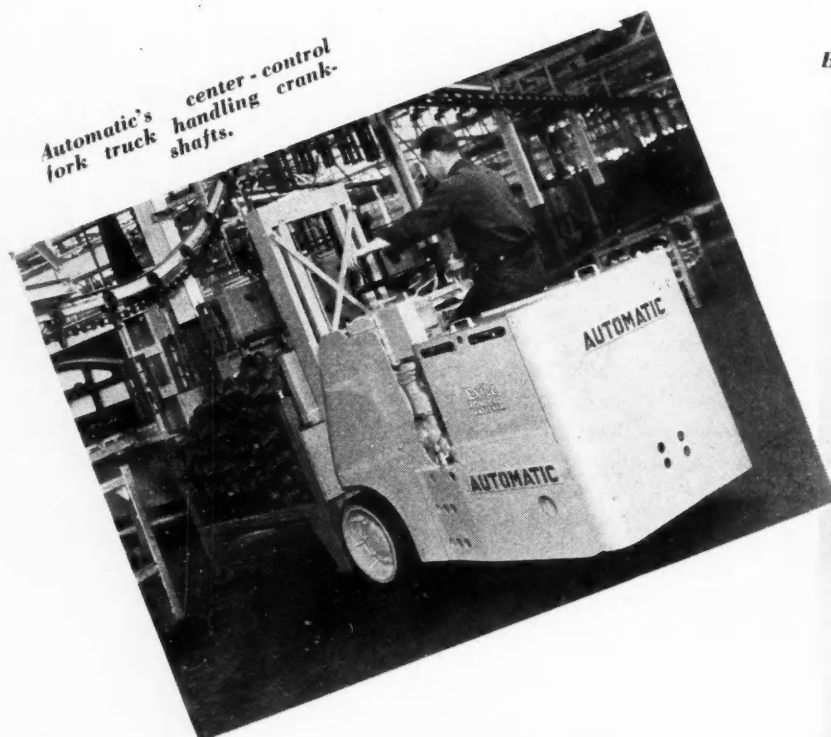
AN EFFICIENT materials handling system, the Clark lift jack with semi-live skid platforms, is offered the market by the All Steel Welded Truck Corp., Rockford, Ill., manufacturer of a wide variety of materials handling equipment consisting of warehouse trucks and trailers. When using the Clark lift jack, 12 in. clear space at the front of a Clark platform is sufficient to engage or disengage it. The jack, which is the interlock-

ing type, weighs 42 lb., and a pressure of 75 lb. on the handle will lift a 6000-lb. load. The system was developed to speed up handling and at the same time to save floor space. (Illustrated on this page.)

AMONG the new products of Automatic Transportation Co. of Chicago is a line of "die handlers," designed to provide accurate die placing. The largest unit of the line, illustrated here, has a capacity of 40,000 lb., while the smallest has a capacity of 10,000 lb. Each unit has a new-type motorized die-handling platform with the mechanism built integral. This comprises two motorized traveling blocks with anchor pins to either push or draw the die. By remote control on either side of the truck, the operator can control these traveling pins, individually or simultaneously, for accurate placement.

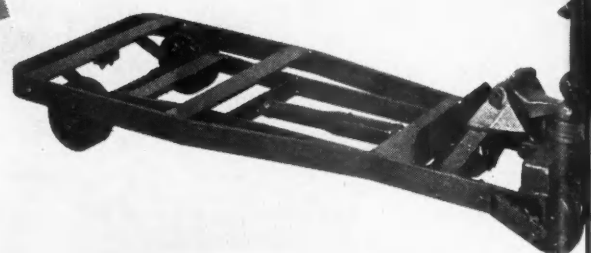
One of the latest type "Automatics" is the telescoping, tilting, tiering, cen-

Material Handling



Automatic's center-control handling crank-shafts.

Barrett Pay Boy lift truck for up to 3500 lb. loads.



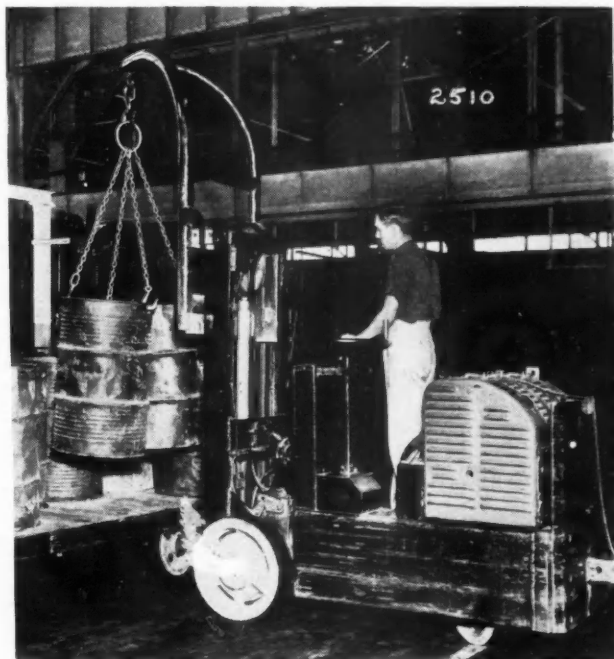


ter-control fork truck now widely used for efficient handling of materials in automobile and aircraft plants and also in munitions plants, Government supply depots and industry in general. It is claimed that practically all types of material, which can be grouped into unit loads, can be quickly and safely transported and stacked with this type of truck, which comes in capacities ranging from 3000 to 7000 lb. (Illustrated on the facing page.)

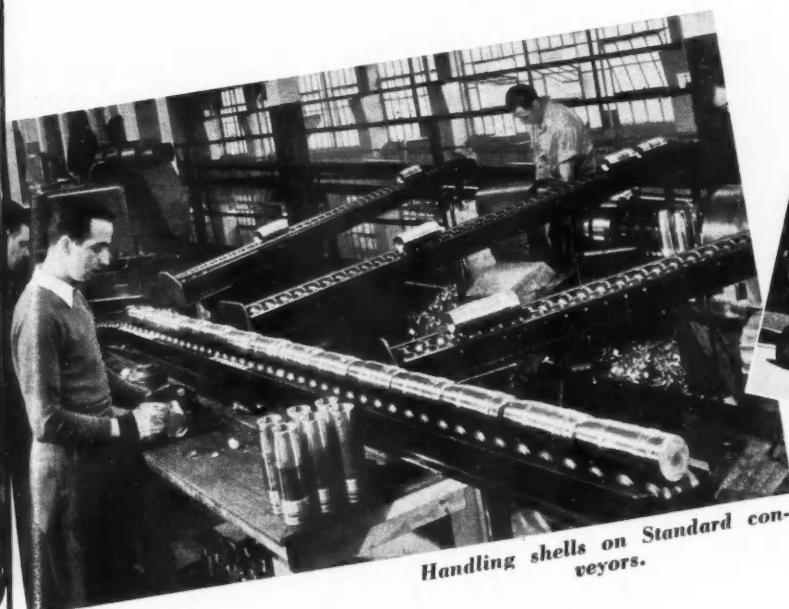
A NEW multiple-stroke lift truck, the Barrett Pay Boy, is announced by Barrett-Cravens Co., Chicago, Ill. It is built for loads of from 2500 to 3500 lb. and will handle all types of skids and platforms up to 48 in. in width, except in the case of the narrow model, for which the maximum platform width is 36 in. The truck is operated by selective lift and hydraulic check. The load can be raised to its full height by either four long or 13 short strokes of the handle. By stepping on the treadle the operator can lower the load to the floor gently.

The truck is of all-steel construction and has a large kingbolt and a low turntable. The four-wheel design is used to ensure stability. The hydraulic check provided with positive control ensures uniform descent regardless of the load. Other features include an adjustable lifting mechanism, ball bearings and Ale-mite lubrication. (Illustrated on the facing page.)

STANDARD conveyors, a product of Standard Conveyor Co., North St. Paul, Minn., are being used to advantage for handling shells in munitions (Turn to page 170, please)



Mercury Model A-1480 lift truck equipped with boom and chain for handling drums with scrap.



Handling shells on Standard conveyors.



Lyon-Raymond elevator for servicing airplanes.

Equipment



New Production

THE HYDRAULIC PRESS MANUFACTURING CO., Mount Gilead, O., claims to have pioneered in the development of press equipment for forming aircraft parts and to have supplied to the industry presses ranging in capacity from 500 to 5000 tons for forming parts by the Guerin process. The photograph reproduced in these columns shows the H-P-M 650-ton press equipped with a 250-ton blankholder and a 133-ton die cushion. The platen and bed are 144 by 72 in. With the H-P-M patented blankholder and die cushion operating system, the pressure is independently adjustable on each blankholder cylinder and on each die-cushion cylinder. At the right of the press is shown a panel board on which will be seen a group of pressure gages. The six gages in the middle are connected to the six blankholder cylinders. Immediately above or below each gage is a control by which the pressure in the blankholder cylinder may be adjusted.

At the extreme right is a pressure gage showing the die-cushion pressure, and below it is the control for adjusting that pressure. During the heat treating operations on gun tubes, there is a tendency for the tube to bend and warp so that it becomes necessary to provide means for straightening after each heat treatment and after each machining operation.

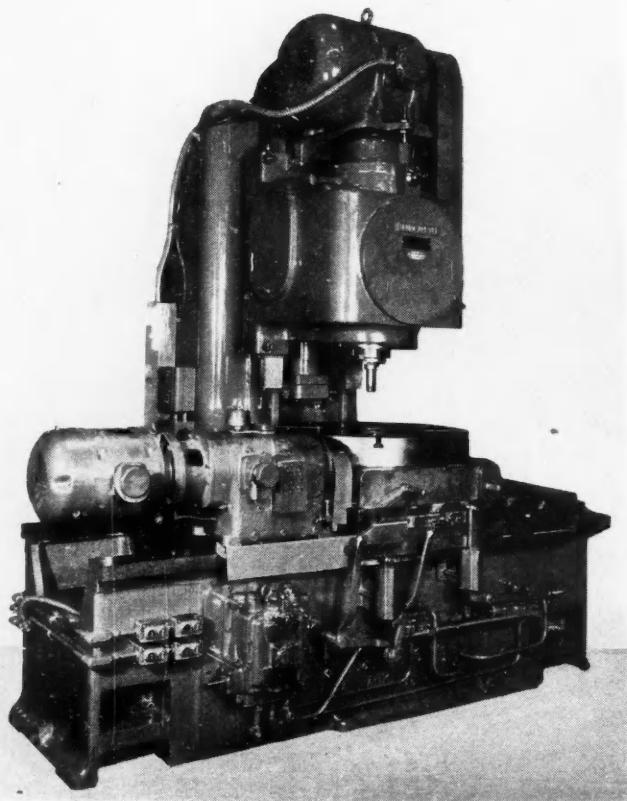
THE MACHINE illustrated herewith was built by the Rehnberg-Jacobson Manufacturing Co. of Rockford, Ill. for operations on an aircraft-engine cylinder head. It progressively drills, countersinks, and taps simultaneously four holes for the mounting of the cowlings. Four fixtures are mounted on a hand-indexed turret, which is rigidly located by a solenoid-operated index pin. Power for feeding the drilling and countersinking tools is derived from cams on a central camshaft. Tapping is by a tapping unit driving individual lead-screw tapping spindles in a four-spindle head. Other special machines produced by this concern include one for

performing 10 operations necessary to complete the windshield hole and the angular slider hole in the M-56 timing-fuse body for the 37-mm projectile, and a center-boring machine primarily developed for manufacturers of heavy artillery, anti-aircraft and naval guns.

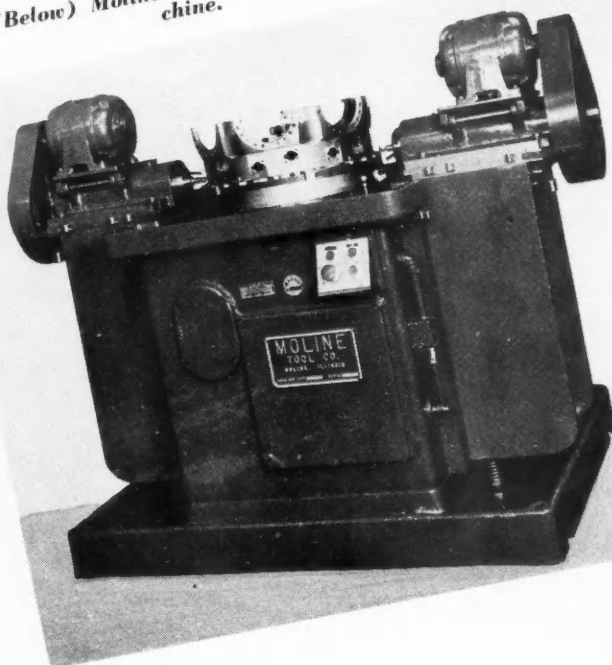
A NEW "openside" vertical, planer-type milling machine, the product of Davis & Thompson Co., Milwaukee, Wis., was designed specially for milling the inside of aircraft-engine crankcases. The work table has a rotary feed with a range of 1/2 in. to 4 in. per min. Milling is done by means of a form cutter mounted on a cutter spindle of 5 7/8-in. diameter driven by a 20-hp. motor. A fluid-drive 1-hp. motor drives the rotary work table of 34 in. diameter. The cycle of operations is as follows:

After the machine has been loaded the table is fed in by means of a starting lever, it stops automatically and the spindle-head lowers. Table-head rotation is then started manually, the cutter feeds to depth as the rotation feed travels, one revolution of the table be-

(Left) Openside vertical planer-type milling machine of Davis & Thompson Co.



(Below) Moline No. 23 milling machine.



Equipment

ing required to complete the cut. When the milling operation is finished, return of the table is started until the head raises automatically. The table is then returned rapidly to the automatic stop and the machine unloaded, which completes the cycle.

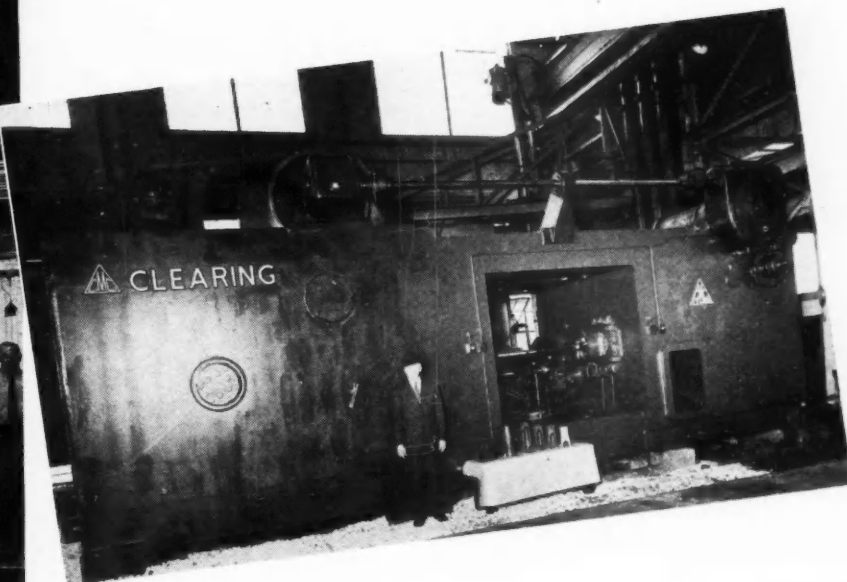
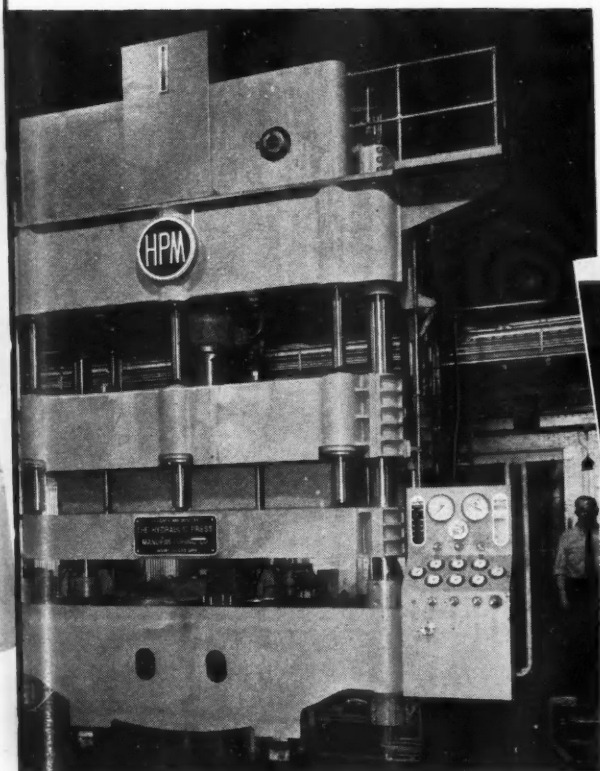
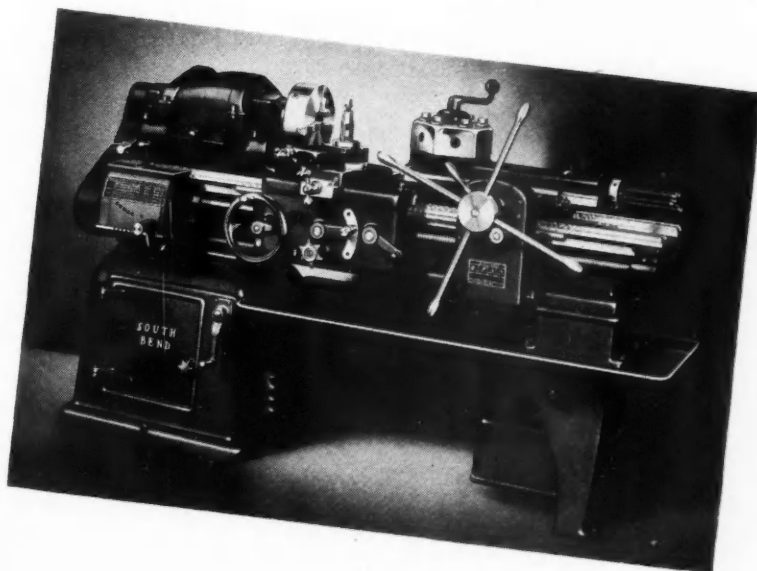
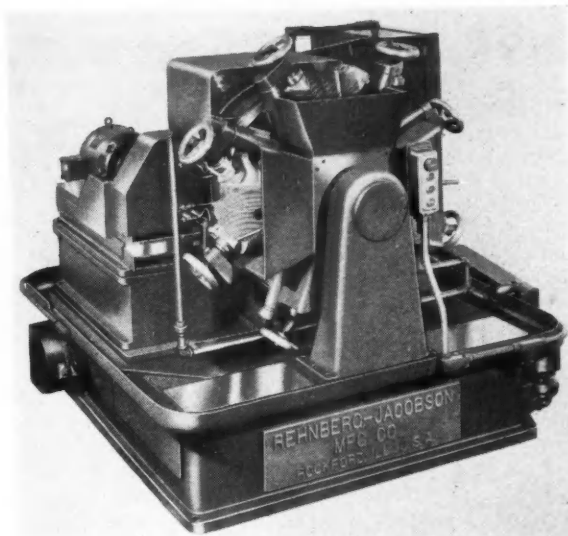
A FOUR-STAGE, completely - automatic, continuous-operation shell-forging machine designed to produce from 240 to 300 finish-drawn 90-mm. shell forgings per hour directly from hot steel billets is announced by Clearing Machine Corp., Chicago, Ill. In the new Clearing press a steel billet is converted into a finish-drawn shell in four operations. In the first operation the billet is slightly upset to fit it firmly in the die, and at the same time it is lightly pierced. In the second, piercing is continued and the billet is changed from a square to a round form. In the third, piercing of the cavity is completed. The fourth operation consists of drawing the shell.

(Lower right) Clearing shell-forging machine.

(Below) H-P-M 650-ton press with panel board for adjusting hydraulic pressure in individual cylinders.

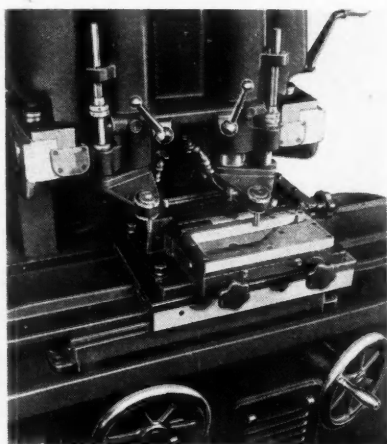
(Right) Rehnberg - Jacobson drilling and tapping machine.

(Right center) New South Bend 16 - in. turret lathe.



NATIONAL BROACH & MACHINE CO.,

Detroit, Mich., offers the industry the new Red Ring profiler, a machine operating on the principle of accurately guiding the travel of an end mill in order to duplicate the profile of a master pattern. To do this, both head and table are mounted on slides, each actuated by its own hand wheel. Manipulating these hand wheels keeps the former pin in contact with the master form and guides the tool. Both head and table respond instantly to finger-tip pressure on their respective hand wheels, this being made possible by careful distribution and balancing of the weight, by mounting both these elements on large-diameter roller bearings, and by the use of hardened and ground slides.

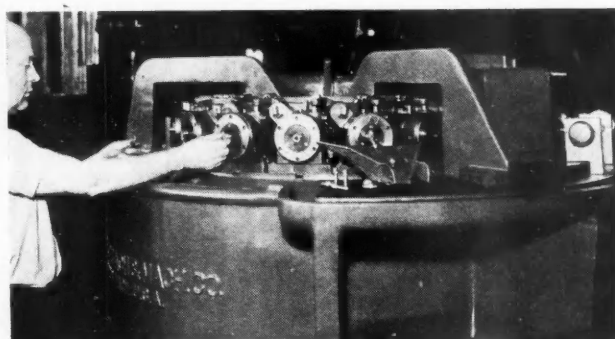


Close-up view of New Red Ring hand profiler

THE STANDARD American rotary broaching machine illustrated here was furnished by the American Broach & Machine Co., Ann Arbor, Mich., to a manufacturer of aircraft parts for broaching the hexagon heads of alloy steel aircraft engine bolts. Fifteen fixture stations are provided, each designed to hold one part by means of an automatic collet gripping the broach shank. Fixture design provides for three indexes to 120 deg. each, about the axis of the bolt, to produce the six flats, two of which are finished in each three successive stages as the part is carried past the broach-holder assembly. Three separate broach-holder assemblies are provided, each broach and holder assembly being designed to finish two flats. Operator loads fixture stations as table revolves clockwise. Parts are automatically clamped and indexed three times, to produce the six flats, and are automatically discharged into the chute. The maximum production rate is 1200 pieces per hr.

AN AUTOMATIC machine has been developed by The Avey Drilling Machine Co., Cincinnati, Ohio, for the production-drilling of small, evenly spaced holes, such as the oil-return

Broaching hexagon heads of alloy-steel bolts for aircraft engines. This machine is an American Broach & Machine Co. product



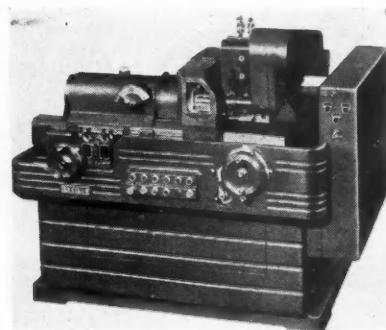
holes in pistons. The set-up shown drills 12 3/16-in. holes in an aircraft-engine piston at the rate of 60 per hr. The machine has a welded, stress-relieved steel base with built-in coolant tank, pump and reservoir, on which is mounted a standard Avey No. 1 cam-feed unit in conjunction with an indexing dial and a work-holding fixture. The indexing movement of the dial is positively synchronized with the cam feed; the fixture, which is fastened to the dial top, is essentially a pot chuck locating the piston by the inside bore of the skirt and the pin bosses, and clamping by a cam-operated finger. Control and timing of the machine are electrical.

EX-CELL-O CORP., Detroit, Mich., has gone into production on a new thread grinder and a new tool-grinding machine. The former, known as Style 39-A, is for internally threaded work and is automatic in operation. It grinds threads up to 5 in. in length within a distance of 15 1/2 in. from the work-spindle nose. The maximum-size hole ground is 9 1/2 in., the minimum, 1 in. The maximum swing is 10 in. A taper attachment available with this machine allows of grinding up to 4 in. diameter per ft. on the effective thread length.

The other new Ex-Cell-O product is a heavy-duty double-end tool grinder for carbides and tools of other materials. It carries 14-in. wheels, and can

be equipped for either dry or wet grinding. This tool grinder, called Style 49, is the sixth and largest of the Ex-Cell-O line of carbide tool grinding machines.

EXTREMELY light in weight and claimed to develop approximately twice the power of ordinary, similarly rated, production-duty electric drills, the U14FS series 1/4-in. Thor "aircraft" drills of the Independent Pneumatic Tool Co., Chicago, are particularly useful for operation in very limited space or in unusually difficult positions. Of small size and compact design, they are available in three different speeds and have side switch style handle for either



Ex-Cell-O 39-A precision thread grinder for internal work

continuous or intermittent drilling. These Thor drills are intended for the hardest kind of production drilling.

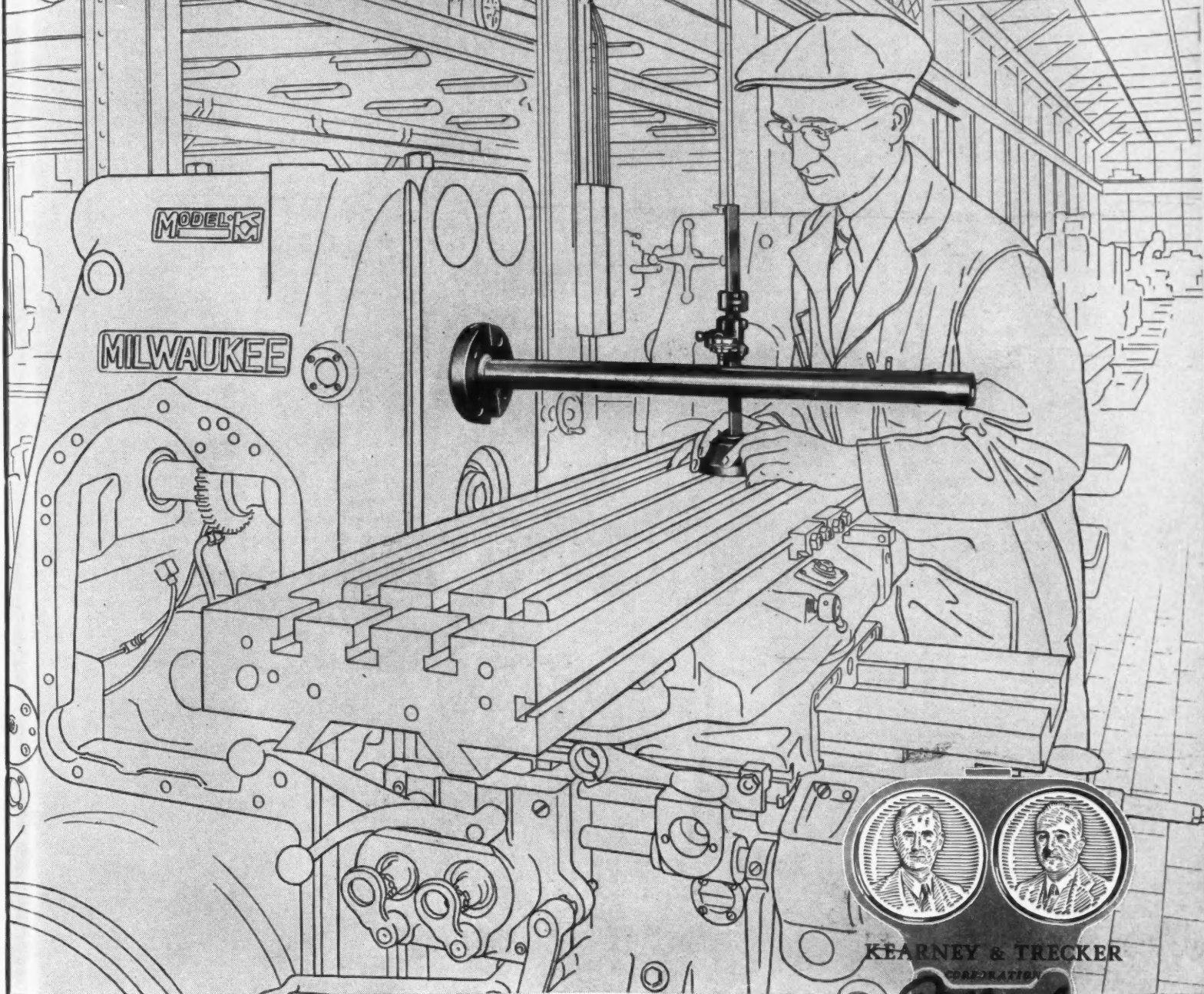
A SET OF two Natco 4AL vertical tapping machines, under which is arranged a roller carriage with a total of seven different positions, is illustrated in the columns. The machines were manufactured by The National Automatic Tool Co., Richmond, Ind., and are installed in the plant of the Packard Motor Car Co., Detroit. Each of the two machines is equipped with one reversing, motor-drive tapping unit and a fixed, center-gear-driven head. The 4AL-243 machine has a total of 32 tapping spindles, complete with individual lead screw and floating tap holders. The 4AL-244 machine has a total of 29 tapping spindles, complete with individual lead screw and floating tap holders. Rotation of the spindles of each machine is interlocked with the



Drilling oil-return holes in pistons in an Avey drill press

Even in this emergency Kearney & Trecker Corporation does not slight its long established policy of making sure that every part — every unit — measures up to Milwaukee standards of milling machine quality and accuracy.

KEARNEY & TRECKER CORPORATION • Milwaukee, Wis., U. S. A.



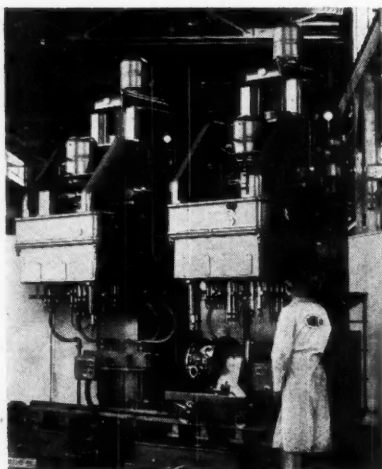
INSPECTION TO DETERMINE SPINDLE RUNOUT.



KEARNEY & TRECKER
CORPORATION



Milwaukee MILLING MACHINES

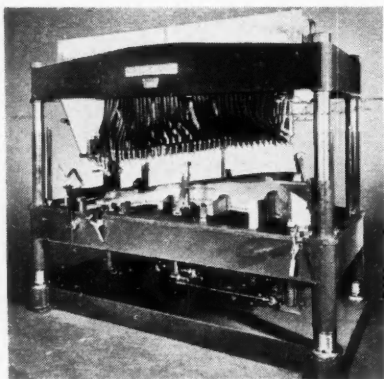


Set of two Natco Holetapper machines

head traverse. The machines are mounted on low bases and provided with automatic pressure lubrication to the ways. There is an interlock between fixture trunnion and machine to avoid cycling to the wrong position. Each machine has a self-contained motor-driven coolant system complete with automatic shut off to stop the flow of coolant when the tools are not cutting.

WELDS AT the rate of 3600 per hr. are produced by the Ultra-Speed unit in assembling a wheel housing by spot-welding to the rear-quarter panel of an automobile body. In the past this job has been frequently performed by flash welding. The complete cycle of the unit requires only 40 sec., including the time required for loading and unloading the fixture, bringing the points down against the work, and going through the welding operation proper. Two welds are made at a time. The Ultra-Speed welding machine is being manufactured by the Progressive Welder Co., Detroit, Mich.

FLEXIBILITY of application to various work diameters, lengths and thread pitches is claimed for the new Landis No. 6 precision thread grinder which has been developed by the Landis Machine Co., Waynesboro, Pa. It also is designed to be used advantageously for

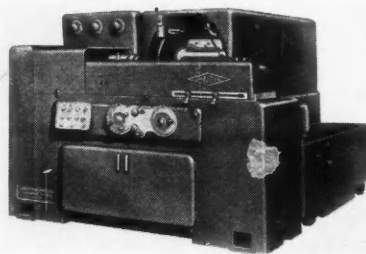


Ultra-Speed spot-welder built by Progressive Welder Co.

jobbing as well as for production thread grinding.

The machine is suitable for grinding both right and left hand external threads from 2 to 80 threads per in., up to 6 in. diameter, 12 in. thread length on work having a maximum center distance of 24 in. Single or multiple National Standard, "V," Whitworth, Acme, Modified Buttress, and Worm threads having a maximum helix angle of 15 deg. may be ground on this machine. Studs, screws, and other parts, which do not have centers, may be ground with the use of a collet type chuck or special work adapter. The flanged nose of the work spindle is machined to conform to the American Standard for lathe spindles. Thus, standard chucks of different types may be employed without using an intermediate flange or adapter.

THE DENISON ENGINEERING CO., Columbus, Ohio, recently adapted one of its standard small-capacity hydraulic presses to the special job of assembling keys and timing gears on automobile crankshafts. The particular



Landis No. 6 precision thread grinder

press (see illustration) is of 5-ton capacity and is entirely automatic. The crankshaft is locked in place and the keys are fed into the press through magazines. Four cylinders assemble the two keys, and the timing gear is pressed into place by the ram. A special safety feature halts the operation of the ram if the keys are not pressed into place properly. The equipment is so arranged that if the timing gear does not fit, the pieces are rejected.

A NEW 10-in. carbide tool grinder combining facilities for straight-wheel peripheral and cup-wheel face grinding has been added to its line by Hammond Machinery Builders, Inc., Kalamazoo, Mich. Work tables tilt up to 25 deg., the angle of tilt being measured by a scale mounted below. Both tables can be locked in any position by the turn of a handle with a plastic knob. Tables are slotted to accommodate the protractor angle guide furnished with the machine and are grooved to keep the working surface clean. The table on the right is mounted directly over a casting which serves as a sludge pan, and by releasing a clamp the entire unit may be removed from

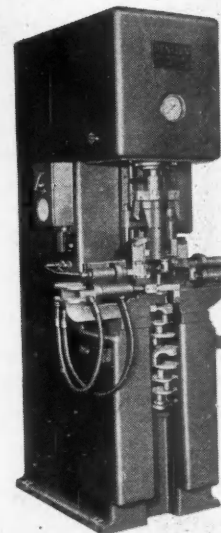


Hammond 10-in. carbide tool grinder

the shaft for the removal of sludge from the pan or the replacement of wheels. For wet grinding with a diamond-cup wheel, the right side of the machine can be fitted with a reservoir mounted directly over the wheel on the cast-iron guard. Drip-feed of moisture to the diamond wheel is controlled by a needle valve.

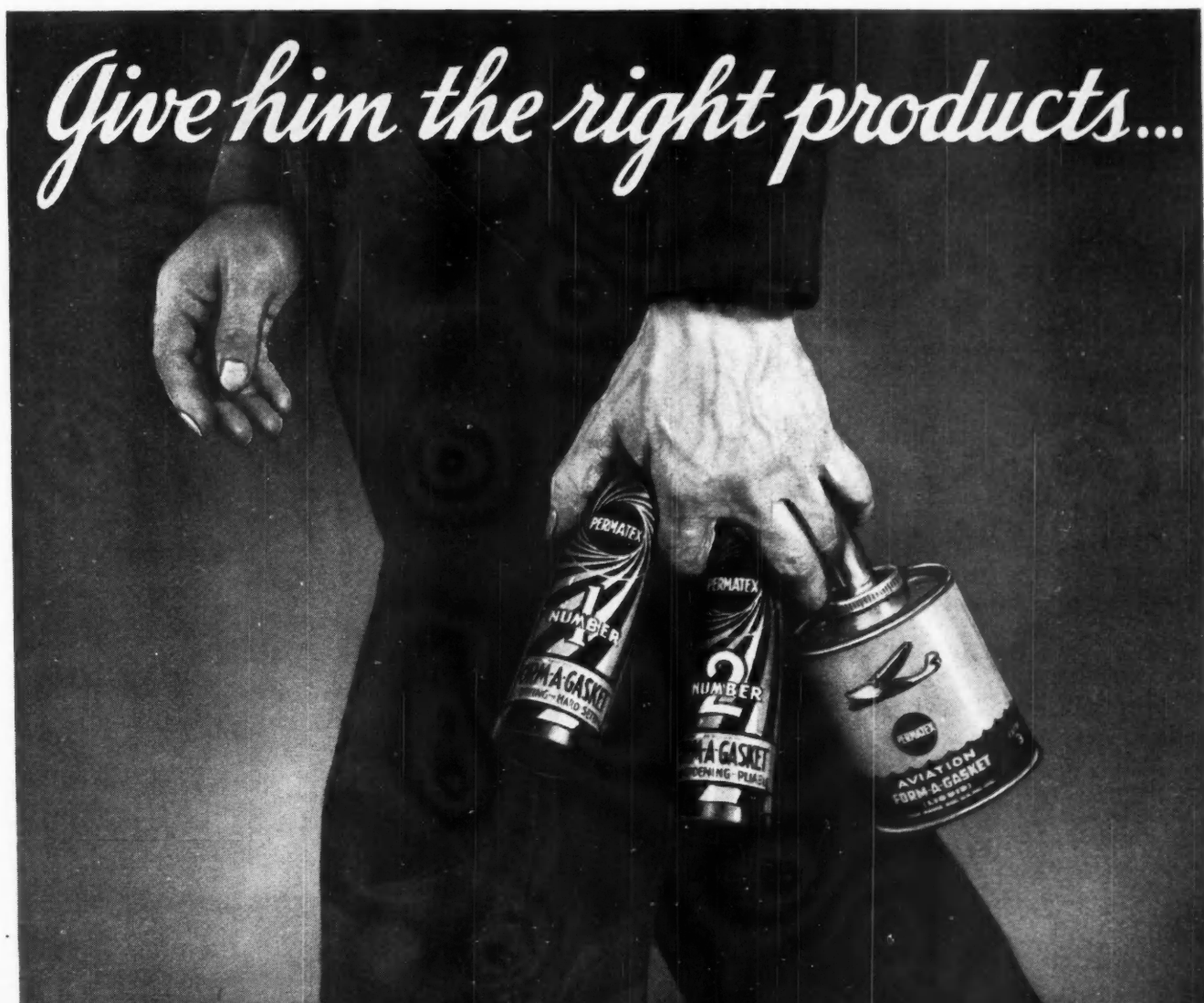
Hammond also has placed on the market a new carbide tool grinder using 6-in. silicon carbide or diamond wheels.

THE 500-ton self-contained hydraulic straightening press shown in the illustration was designed and built by A. B. Farquhar Co., Limited, York, Pa., for straightening large gun barrels and heavy shafting. Its bed is 32 in. wide by 26 ft. long, the "daylight" is 41 in. and the stroke of the ram, 24 in. The main pressing unit is supported on the bed of the machine by wheels equipped with ball bearings. The traverse mechanism consists of a motorized unit with pushbutton control located on the col-



Denison hydraulic crankshaft assembling press

Give him the right products...



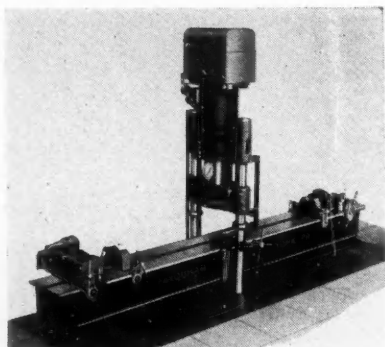
HE KNOWS HOW TO USE THEM!

He knows that Form-A-Gasket Number 1 is a paste that dries fast and sets hard. That it is used principally for making permanent assemblies and for building up uneven or warped surfaces. That it withstands highest pressure and greatest strain.

He knows that Form-A-Gasket Number 2 is a paste that dries slowly, remains pliable and disassembles very easily. That it is principally used for general assembly work. That it preserves all types of solid gaskets from heaviest copper to thinnest cork.

He knows that Aviation Form-A-Gasket is a liquid that quickly changes to a paste and does not dry nor run when subjected to heat. That it is used on cylinder head gaskets to prevent water seepage, corrosion and head seizure. That it is extensively used on machined surfaces and screw thread connections.

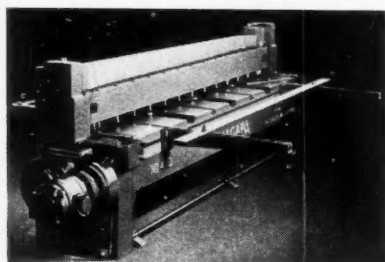
PERMATEX COMPANY, INC., Sheepshead Bay, N. Y., U. S. A.



Farquhar hydraulic straightening press.

umn. It is claimed that this control permits precise setting of the pressing unit at any point of the bed. Power drive from the motorized unit is transferred to the bed of the machine through a shaft-and-gear assembly underneath the machine. The main pump unit and drive are located at the top of the press. The bed is equipped with solid V pressure blocks which are moved along by hand. These blocks are so designed that they will pass between the columns of the press.

NIAGARA MACHINERY & TOOL WORKS, Buffalo, N. Y., has brought out what is known as the Series 4 Niagara power squaring shears, which have capacities of 12 to 16 gage and 4 to 12 ft. lengths. Greater accuracy and higher production than possible with earlier machines are claimed for the new line. Strips may be cut at the rate

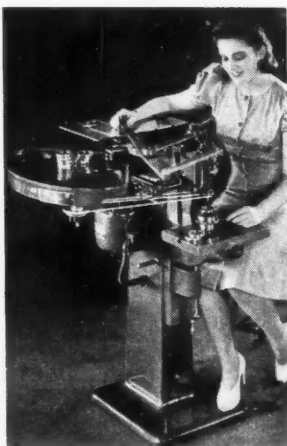


Niagara Series 4-power squaring shears.

of 75 per minute on 60-cycle current. The drive, including the flywheel, gearing, clutch, eccentrics, and connections, is wholly enclosed within the machine and operates in a bath of oil. A new detent device is featured, which completely replaces the customary friction brake and requires no adjustment or attention.

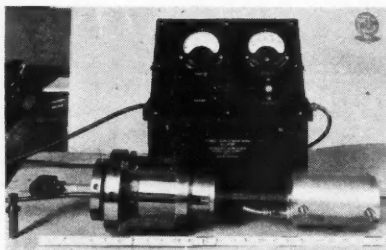
GEORGE GORTON MACHINE CO., Racine, Wis., has developed a "stripped down" engraving machine, the Model M-E Munitions Engraver, specially for defense work. It is intended to engrave or profile such parts as gun-range scales, indicator plates, gun barrels, airplane-propeller pump housings,

range-finder bands, gun-sight dials, gun-elevation scales, Air-Temp dials and many other parts. By eliminating many of the controls and adjustments necessary to give the standard machine its versatility, Model M-E can be produced in approximately one-third the time. The M-E model has a fixed pantograph reduction ratio, while standard machines have a reduction-ratio range of 2 to 40. Further savings in both material and labor result from making the table adjustable only in the vertical direction.



Gorton Model M-E munitions engraver

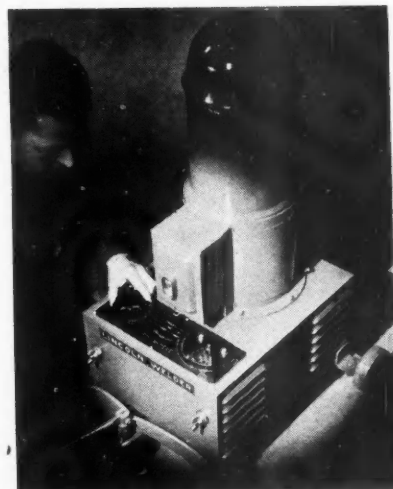
AN INDUCTION-TYPE device for indicating eccentricity in tubes and gun barrels has been introduced by Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia. Known as the Haskell gun-bore straightness indicator, it is a self-contained unit designed to be fitted to the ends of a gun barrel while the latter is being straightened in a press. In operation, an induction head is moved in steps through the bore of the gun barrel to be straightened while the latter is being rotated about the head at each step. An electrical circuit is arranged to detect eccentricity of the bore by variations of the magnetic gap between



Haskell gun-bore straightness indicator

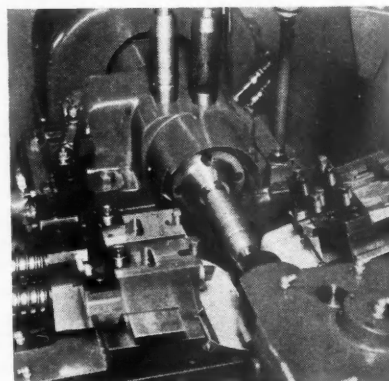
the pole pieces of the induction head and the wall of the tube. The equipment requires a source of 110-volt, 60-cycle A. C. power supply and can be connected to any A. C. lighting circuit. Indicators are available for both cold and hot straightening operations, the latter for temperatures not in excess of 800 deg. F.

A NEW "aircraft arc welder" has been developed by the Lincoln Electric Co., Cleveland, O., to meet a demand resulting from the national defense program. It incorporates the Lincoln system of "dual continuous control" by which both the voltage and the amperage of the welding current are individually controlled to meet the requirements of the analyses and gages of metal used in aircraft construction. Suited to welding the lighter gages of aircraft steel, the "aircraft arc welder" delivers 10 amperes at the arc without extra attachments, and has a welding range for heavy materials. High overload capacity is said to enable it to withstand continued operation within the upper portion of its range. The "aircraft arc welder" has connections for either 220 or 440 volts, and can be supplied also for 550 or special voltages, three- or two-phase, 60-cycle. It



Lincoln aircraft arc welder

occupies less than 4 sq. ft. of floor space and is available in two models, 150- and 200-ampere, either portable or stationary.



Lo-Swing IMP lathe tooled for finish-turning 40-mm. shells.

THE LO-SWING IMP lathe, manufactured by Seneca Falls Machine Co., Seneca Falls, N. Y., has been found well suited to finish turning 40-mm. high-explosive shells, and the illustration shows a close-up view of the tool-



WE RENEW OUR PLEDGE

Two years ago, at the beginning of the present war with its uncertainties and threats to the future of all industry, this Company publicly pledged itself not to increase its selling prices.

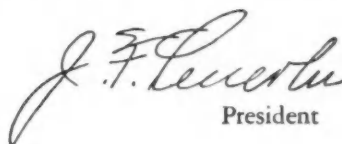
On this, the second anniversary, we again publicly renew that pledge.

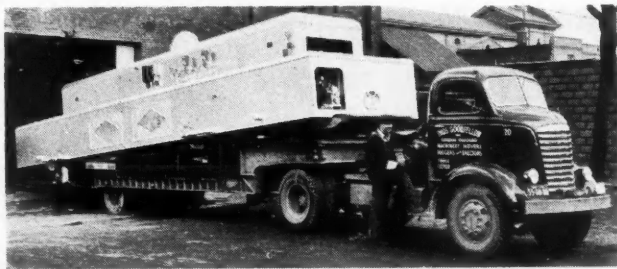
During the last two years we have not only kept the pledge previously made, but *we have actually reduced our selling prices by more than 6%* because of more efficient operation made possible by the marvelous cooperation and ability of our organization. This was accomplished in the face of rising labor and material costs, both of which have been increased by considerable amounts.

It is our belief that the only hope for the continuance of the present industrial system now threatened from within and without is in its ability to give more and more to the consumer for less and less of his dollar. This is the strength of American individual initiative. This is the hope of our country's future. If American industry can accomplish this universally, we need not fear dictators either at home or abroad.

THE LINCOLN ELECTRIC COMPANY

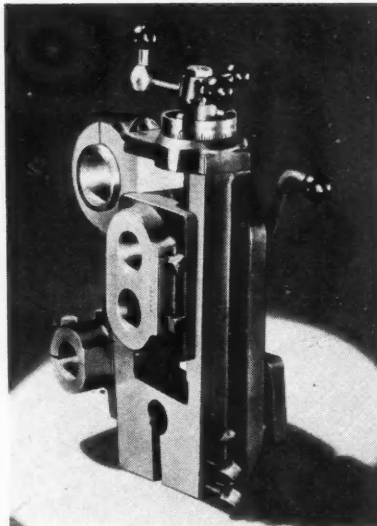
Cleveland, Ohio
October 2, 1941


President



Large International washer en route to the Chrysler tank factory

ing with the covers removed from the template-controlled tool blocks to show the construction. The shell is held and driven on the head end by an air-operated expanding collet chuck. It is supported at the tailstock end by a revolving expanding bushing which enters the small-diameter bore of the work. The outside diameter is turned over its full length with two template-controlled tool blocks which finish-turn the nose, the boat tail, and the cylindrical body. Movements of front and rear slides are synchronized. The machine stops automatically, with tools and slides returned to the starting position. The tailstock spindle is air-operated to cut the handling time.



Gisholt turret lathe tool

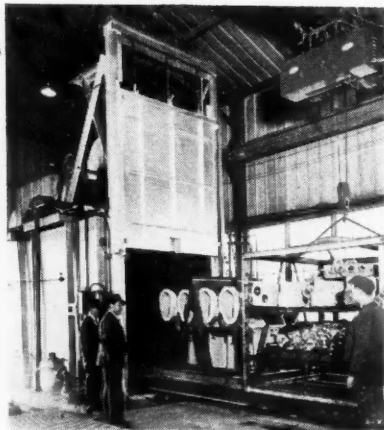
chine. It is of the cross-bar type, of very heavy construction, and will carry parts weighing up to 7200 lb. each. Operation is continuous, the conveyor traveling at a speed of 3 ft. per min. All pumps, motors, pump headers and other pipe work are enclosed, the only exposed parts at the side of the machine being the electrical controls for the pump motors and the automatic temperature regulators.

A NEW TYPE of heat-treating furnace developed by Despatch Oven Co., Minneapolis, Minn., is suitable for heat-treating and aging aluminum alloy castings, tempering and drawing alloy steels, normalizing and annealing castings and welded structures, and for other processes in which temperatures

up to 1200 deg. Fahr. are required. The illustration shows one of three Despatch furnaces installed at the plant of the National Bronze and Aluminum Foundry Co. in Cleveland for heat-treating aluminum alloy castings for aircraft engines, etc. At the factory the furnace is fabricated in panel sections and erection at the point of installation is said to require only eight days. The furnace shown is 7 ft. wide, 8 ft. high and 15 ft. long (inside measurements). From 6000 to 7000 lb. of aluminum castings are placed on the car shown in the photograph.

AN IMPROVEMENT recently incorporated in Ajax forging machines and presses, built by The Ajax Manufacturing Co., Cleveland, O., is a double-draft ventilation feature. Air in great volume is pulled in by the scoops at the hub on both sides of the flywheel, forced outward by centrifugal force between the friction surfaces of the clutch plates, and discharged through openings in the outer clutch housing just inside the flywheel rim. This double draft provides a generous circulation of air and keeps the friction surfaces cool, thereby prolonging their life. The clutch is housed within the flywheel, which is mounted between widely-spaced anti-friction bearings. These bearings, which are readily accessible for lubrication, have labyrinth grease

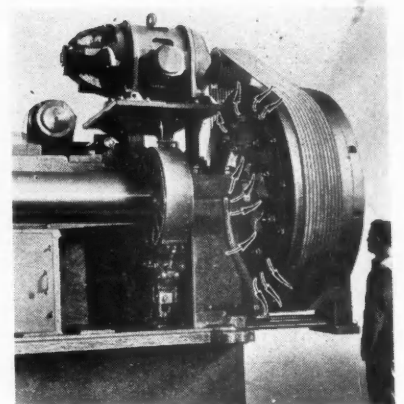
(Turn to page 165, please)



Despatch furnace for heat treating aircraft engine aluminum castings.

SEVERAL industrial washing machines have been supplied by International Conveyor and Washer Corp. of Detroit to the Chrysler Corp. for its tank arsenal, and the accompanying photograph shows the largest of these washers which, in fact, is one of the largest ever produced by the former. It is designed for washing transmission housings. The washer is 9 ft. wide, 8 ft. high and 50 ft. long. It is a two-stage machine, the first or alkali-wash stage being equipped with a pump having a capacity of 1150 gals. per min. when operating against an 80-ft. head, and the second or rinse stage with a pump having a capacity of 925 gals. per min. against a 75-ft. head. The first-stage pump requires a motor of 30, and the second of 25 hp.

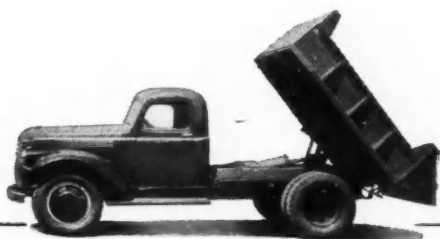
Parts to be washed are placed on a conveyor which forms part of the ma-



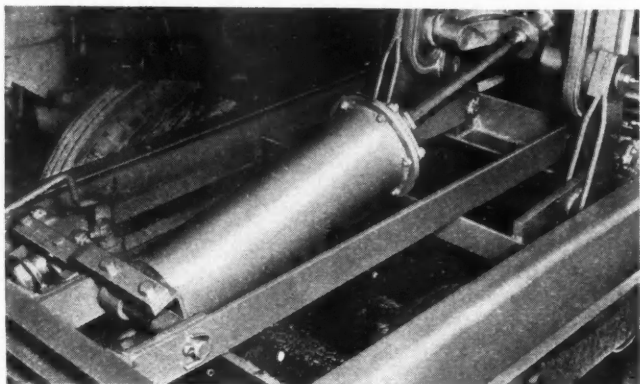
Air-cooled clutch of Ajax forging machine

Philadelphia-Type face grinder offered by Diamond Machine Co.

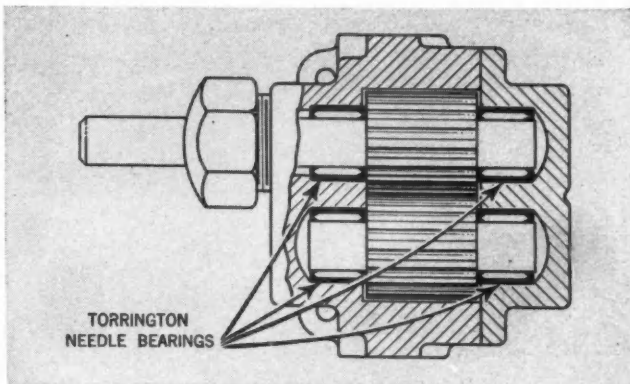




WEIGHT IS CUT, EFFICIENCY BOOSTED, ASSEMBLY SPED BY NEEDLE BEARINGS IN MARION TRUCKS



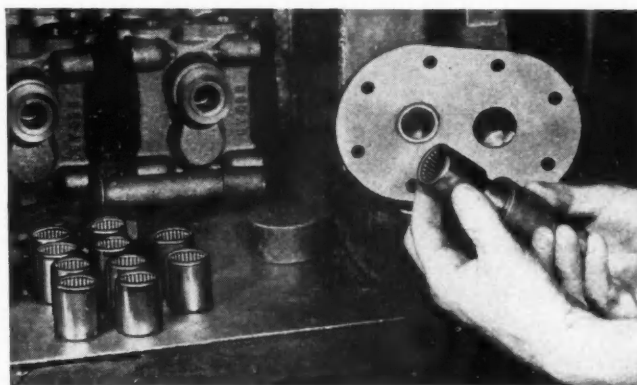
1 THE PUMP IS THE HEART of any hydraulic mechanism, such as the Marion Dump Truck hydraulic hoist, shown above. "With the use of anti-friction Torrington Needle Bearings, our pumps are cool and efficient in operation," states L. H. Guthery, vice-president of The Marion Metal Products Co.



2 "SAVINGS IN SPACE are made possible in the pumps by four Torrington Needle Bearings, which have smaller outside diameters than other bearings of the same high load capacity," Mr. Guthery continues. "These bearings permit lighter housings, less weight, and more payload for our trucks."

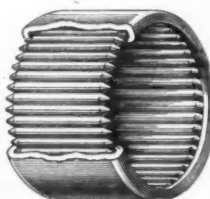


3 "EASY, QUICK INSTALLATION of the Needle Bearings—which require no complicated bores or expensive lock rings—gives us substantial reductions in costs. We just press the self-contained units into the housings," says Mr. Guthery. Note, above, that simple hand presses are used.



4 AMPLE LUBRICANT IS RETAINED over long periods of time in Torrington Needle Bearings because of the close fitting, turned-in lips of their race. This helps the pumps to withstand severely trying conditions and to achieve excellent intermittent service at variable speeds up to 2500 rpm under heavy loads.

Your product, too, may gain important advantages by utilizing the small size, high radial load capacity, lubrication features, and surprisingly low cost of Torrington Needle Bearings. Call on our Engineering Department for full



assistance. For detailed information, write for Catalog No. 107. For Needle Bearings to be used in heavier service, write our associate, Bantam Bearings Corporation, South Bend, Indiana, for Booklet 104X.

THE TORRINGTON COMPANY, TORRINGTON, CONN., U. S. A. • ESTABLISHED 1866

Makers of Needle and Ball Bearings

New York, Boston, Philadelphia, Detroit, Cleveland, Chicago, Los Angeles, London, England

TORRINGTON NEEDLE BEARING

As to Defense Metals-

(Continued from page 63)

to how much of the steel that goes into defense material, armament, munitions, etc., will return in the form of scrap and when.

Heavy export shipments to England of semi-finished descriptions of steel, the scrap from which will remain overseas, at least for the time being, have further complicated the scrap supply problem. Another cause of befuddlement to the lay mind is the traditional method of steel mill accounting for purposes of raw material control. Scrap that arises in the manufacture of steel, such as when the ends of billets or bars are cropped, all of which is reused by the mills, is listed as Home Scrap. Scrap coming from outside sources usually is referred to as Purchased Scrap. This, of course, is well understood by those in the industry, but it is mentioned here merely to point out that outside judgment on the convolute scrap problem is apt to limp because of some misconception.

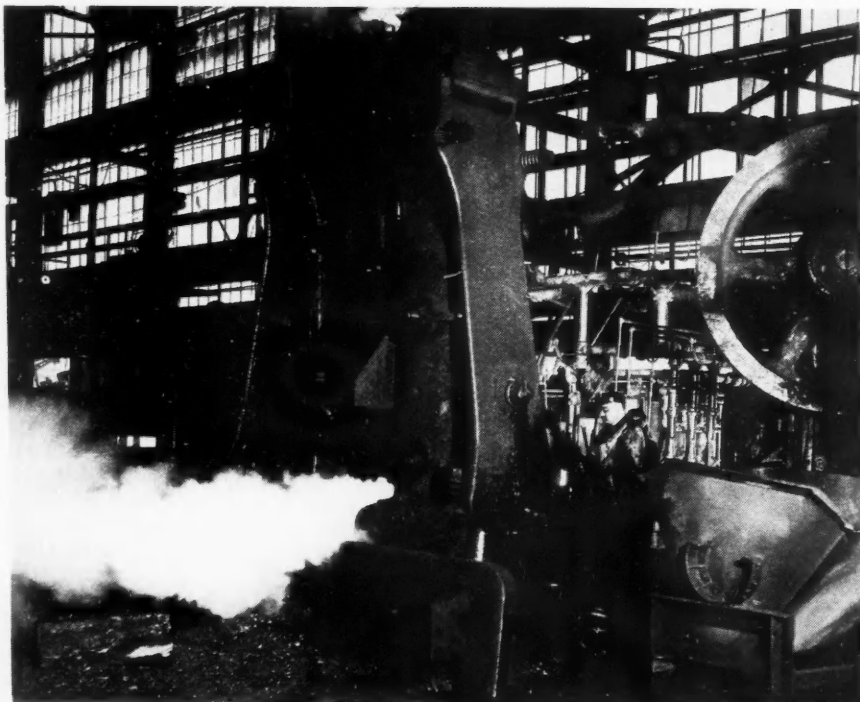
The need of giving thought at this time to the future of our scrap supply is obvious unless our iron ore resources and blast furnace capacity are made to yield a greatly increased share of the basic material from which steel is made. There are potent arguments against over-expansion in this direction as the supply of scrap constitutes a vital revolving fund of the most essential raw material. Because so large a part of it must come from the scrapping of cars, the availability of this reclaimed product will constitute for some time to come the chief factor of limitation in the automo-

tive industries. Hence the scrap situation now is as much the problem child of automobile manufacturers as of steel producers.

Steel

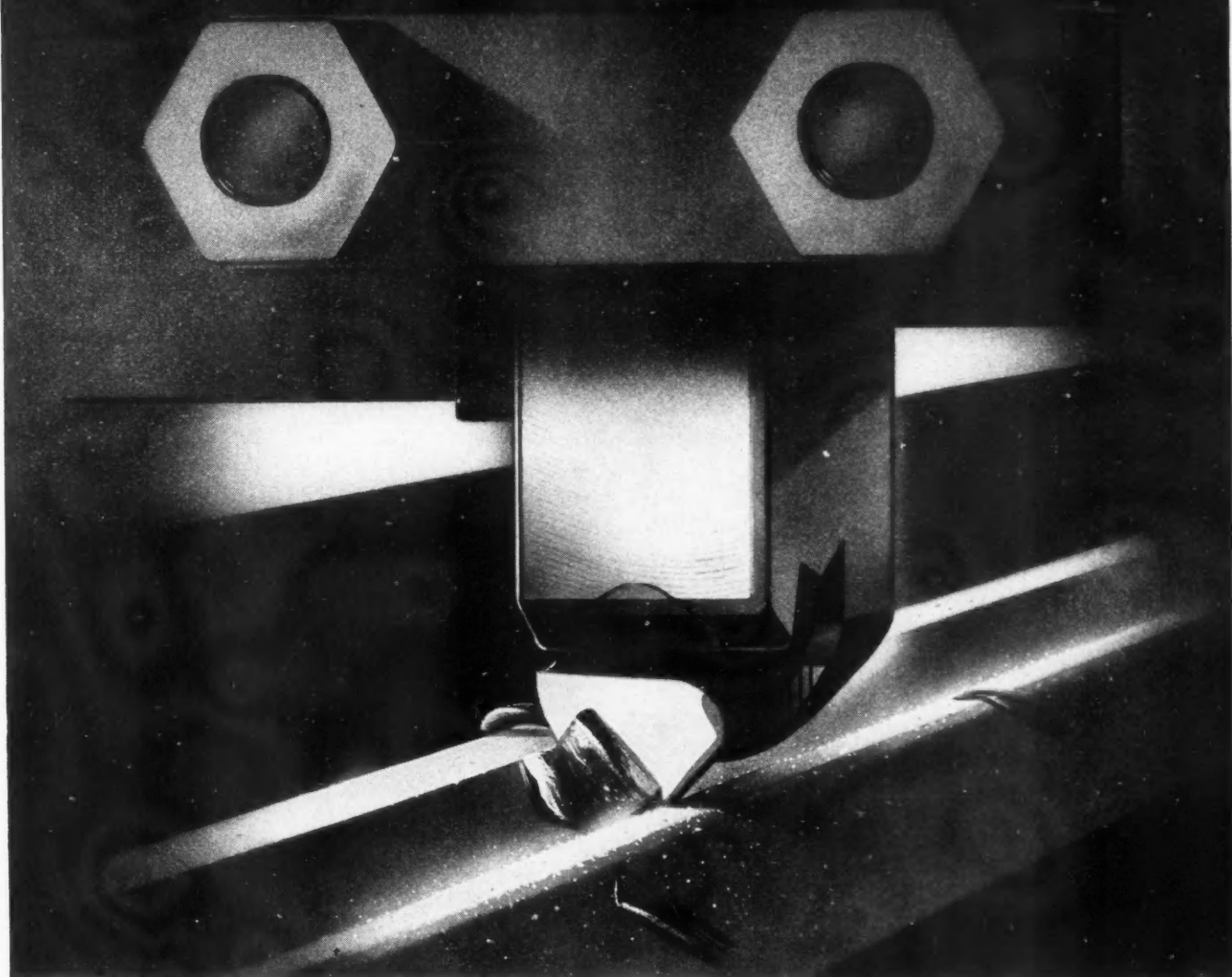
When the vastness of the task of realignment in the steel market made necessary by the defense program is taken into consideration, the orderly manner in which it was carried out challenges admiration. It was nothing short of remarkable how steel buyers as well as steel consumers lined up in support of price stabilization. It is in the very nature of priorities that they engender dissent, where this or that manufacturer thinks he should have been accorded a higher rating, and so establishment of out-and-out priority control over steel could hardly be expected to be followed by all steel consumers seeing eye to eye. But the question of price does not enter into any of the dissensions over deliveries. Reiteration by the American Iron & Steel Institute of the steel industry's contention that its capacity is adequate for the production of the Nation's defense and civilian requirements, supported by a statistical showing detailed in character, came as reassurance that once requirements have been more thoroughly probed, as they now promise to be under SPAB direction, the position of civilian industry under the defense set-up will be clarified and the lot of the non-priority steel consumer eased.

In the earlier stages of the defense program, it was thought that the scarcity of certain alloying elements and the need of these for important armament would lead to a comprehensive substitution in not strictly military products of steels not calling for those alloying elements limited in supply. To some extent this expectation has been fulfilled, but full standardization of these substitute steels must be deferred while the supply of certain minerals and rare metals depends in so large a degree upon transportation security.



Uninterrupted flow of alloy steels is necessary so that forge shops can continue turning out aircraft and other forgings to meet defense and civilian needs.

Molybdenum High Speed Steels combine performance with economy



No reduction in the cost of tools could be enough to overcome inferior performance. Fortunately, Molybdenum high speed steels, which cost less than the Tungsten types, combine lower purchase price with equal performance.

Users know that improved cutting properties, better

toughness and lower cost progressively bring about tool cost reduction.

It will pay you to call in your supplier for the analysis and heat treatment of the Molybdenum high speed steel that is most suitable for your cutting and cost requirements.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • CALCIUM MOLYBDATE

Climax Molybdenum Company
500 Fifth Avenue • New York City

Good progress continues in making the benefits of special heat treatment methods supply in part the properties inherent in these alloying media. Steel plant metallurgical laboratories must expect "for the duration" to be on a day-to-day basis, with some materials more freely available one week than the next.

It was only natural that the changed order of things should result in the evolution of a number of steel innovations designed to further the defense program. The greatest advance appears to have been made in the composition and rolling of electric steel, the increase in the number of electric furnaces being perhaps the most spectacular development. One manufacturer has announced the production of an electrical steel sheet, so thin as to permit its being run through a typewriter. This steel serves in airplane self-starters. Other electric types of steel have greatly improved the transformer cores of airplane generators. Surface and submarine navy craft are also benefited by special types of electric lightweight steel. The American Iron & Steel Institute recently published a list of Standard "Ranges and Limits for Chemical Composition," applicable to electric furnace carbon and alloy steels, which is highly informative. In this connection it may also be mentioned that the Institute has published revisions of other sections of its "Steel Products Manual," containing much in the way of valuable data pertaining to standards that, if observed, will obviate ambiguity in steel specifications.

Non-Ferrous Metal

Establishment of price ceilings for virtually all non-ferrous metals has been followed by more or less complete control of supplies. At the time this is written, mandatory priorities were seen imminent even for lead, a metal in which producers have skilfully balanced supply and demand for years. In fact, late rumors from Washington are to the effect that the Government through the Metals Reserve Company, one of its agencies, plans to become soon the sole importer and distributor of tin and chromium and the sole marketer of copper, zinc and a number of other important metals. This report stems from information that a thorough study of foreign metal prices and their effect on manufacturing costs is being made and that a final decision, creating what would virtually be a Government monopoly in the base metal field, will hinge on the findings of this inquiry.

Allocation of nickel, confined almost entirely to defense needs in the form of an alloying element for steel, has become a routine affair. In one quarter it is estimated that defense requirements over the remainder of the year will absorb 60,000,000 pounds. Minor relief from the dearth in the nickel supply as the result of defense needs is obtained by civilian users through recourse to what limited tonnages of nickel can be reclaimed from different types of scrap. Moderately increasing tonnages of nickel are expected to be available for non-military uses next year.

Allocation of copper by the Metals Reserve Company proceeds smoothly considering that there is a tight fit between supply and demand. Much of the copper, coming in from South America, is in the form of ore or blister, and first must be refined in this

country before it is useful to consumers. This, together with exaggerated demands by some consumers which it takes time and correspondence to scale down to the buyer's actual needs, is the cause of much work for the Metals Reserve Company staff. Many copper users hearing of the arrival of a cargo of copper from South America think that they should have the metal made available to them on the same day. Little in the way of complaints is heard from the large Connecticut Valley brass mills, but some of the smaller fabricators are said to have to contend occasionally with threatened interruptions of plant operations because of delays in the arrival of needed copper. The price situation is adjusting itself. Michigan copper producers have been offered a premium for their output so as to compensate them for higher production costs and to enable them to institute a higher wage scale for their labor. Small Arizona copper producers, however, complain bitterly that the price of copper is out of line with commodity market levels and that they are the victims of this disparity. In normal times neither the Michigan nor the Arizona small mine production would be likely to affect the market as a whole, but in a period of stringency, such as the one confronting copper consumers just now, every pound of red metal counts, and to bring idle copper mines into production without raising the general price level continues to be one of Price Administrator Leon Henderson's most ticklish problems.

For a time tin importers thought that in spite of the establishment of the 52-cent maximum price, reasonableness in Singapore and other primary markets would permit them to continue to operate. Recent developments have lessened their confidence in that respect. Speculation in the Far East continues in spite of the contraction of the market here under the influence of governmental restrictions, and on several days recently Singapore prices were virtually on a par with the ceiling price here, bringing business to a standstill. The Metals Reserve Company is paying for Bolivian ore on the basis of a tin price of 48½ cents, Texas City. This should attract to United States considerable Bolivian tin that heretofore went to England, because quite frequently of late the price there was considerably lower.

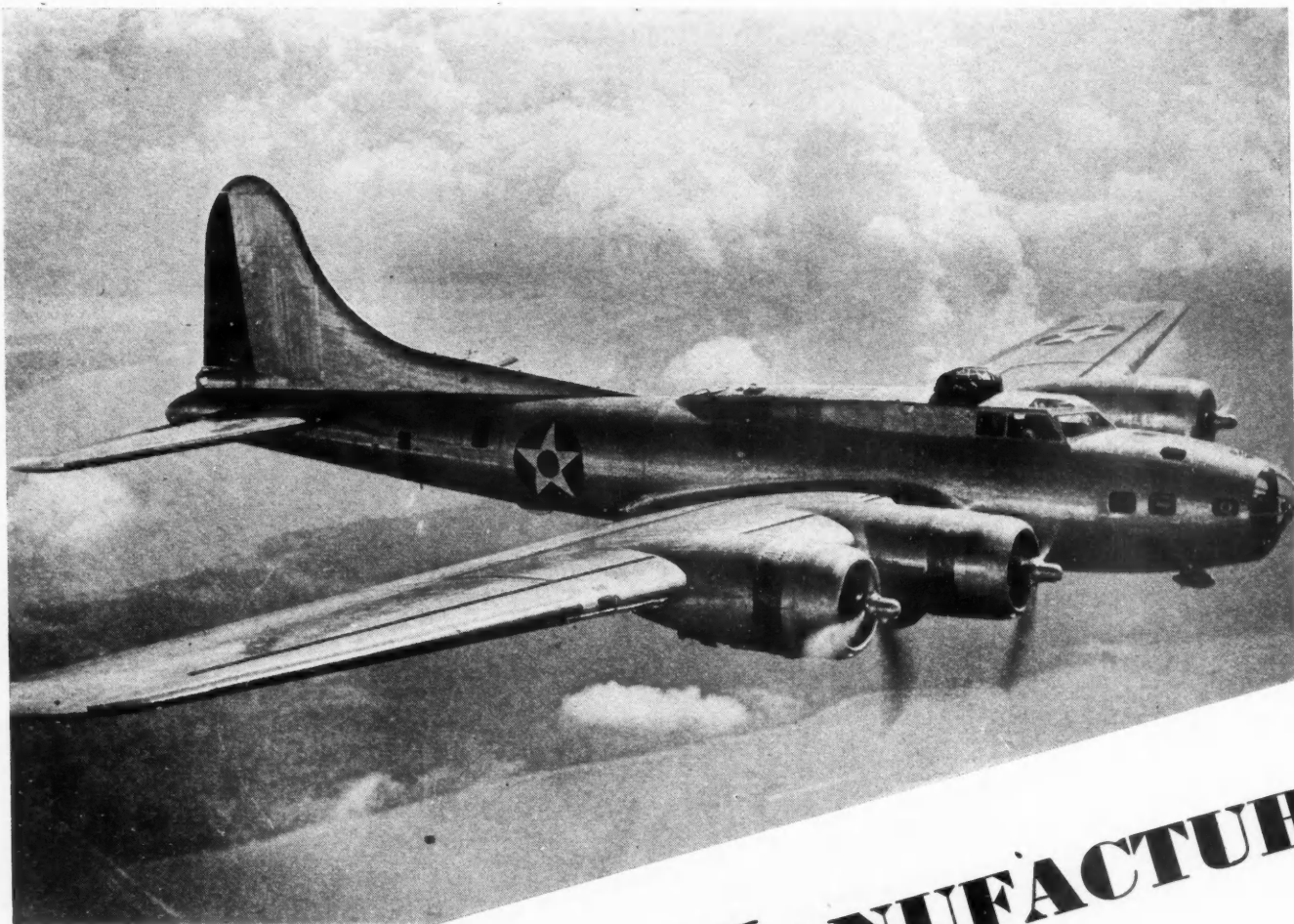
According to a recent announcement by Jesse Jones, Federal Load Administrator, expansion plans being pushed by the Defense Plant Corporation should add 30,000,000 pounds a year to the country's aluminum capacity and 108,000,000 pounds a year to magnesium output in the next 12 to 15 months. This expansion will be in addition to plans previously reported for the construction of three more ALCOA plants in different parts of the country. From this it is expected that by the end of 1942 the shortage in these light metals will have been fully relieved.

UNITED AIRCRAFT CORPORATION, East Hartford, Conn., has been granted a patent on a composite engine bearing. The bearing comprises a steel shell which is internally lined with silver; the surface of the silver is roughened and has a layer of lead deposited on it electrolytically. The lead coating, which is only about 0.006 in. thick, may be finished by rolling.



Aircraft Manufacturing for DEFENSE

It is now evident to all that the aircraft manufacturers are working full-out in the present program as a well-organized and thoroughly established industry. It is no war baby. In official circles, we are told, there is general recognition of the fact that the industry is doing a good job in the defense program. Because of that happy circumstance as well as other reasons explained in the following pages, the industry should emerge from the war and postwar readjustment period even more firmly established than ever before.



AIRCRAFT MANUFACTURE

By COL. JOHN H. JOUETT*

ONE OF the main obstacles to coherent analysis of the aircraft manufacturing industry today is the fact that nearly all the important details must be withheld for military reasons. We must constantly bear in mind that almost anything of interest to us in connection with defense activities is of interest to the enemy. Full and frank discussion, therefore, is out of the question.

If we refer to the work of our manufacturers in recent months as an industrial miracle, we can give only the barest details by way of proof. We can quote officially released figures showing a production of more than 1800 planes last August as compared to about 586 in that month a year ago; but we cannot stress the inside story, the real achievement in producing certain types of combat planes. We cannot, for example, show the precise state of progress by giving the actual number of machines weighing 1500 lb.,

* President, Aeronautical Chamber of Commerce of America, Inc.

as in the case of some trainers, and those of 45,000 lb. or more represented by the 4-engine bombers.

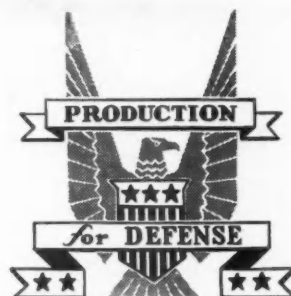
Again, we can say that we have continued to improve the performance of our combat planes so that they are superior in some categories to any in service abroad; yet we cannot give the speed, altitude, range and fire power of these new machines. If an enemy can learn the exact performance of a plane, he will know precisely what he must have his designers do in order to send up a new machine to knock ours out of the skies. This need for secrecy will continue until the end of the war.

On the other hand, there are many facts which are so apparent as to preclude any attempt at secrecy, if such were desirable. It is now evident to all that the aircraft manufacturers are working full-out in the present program as a well-organized and thoroughly established industry. It is no war baby. In official circles, we are told, there is general recognition of the fact that the industry is doing a good job in the defense program. Because of that happy circumstance as well as other reasons to be explained here, the industry should emerge from the war and postwar readjustment period even more firmly established than ever before.

Three Pacific Coast aircraft manufacturers—Boeing, Douglas and Vega—have arranged a joint “pool” for quantity production of these B-17E bombers (left), America’s advanced version of the Boeing Flying Fortress B-17D. Boeing will build them at its Seattle, Wash., and Wichita, Kan., plants, Douglas at its new Long Beach, Cal., plant, and Vega, a Lockheed subsidiary, at its new factory, Burbank, Cal. In addition, certain subassemblies, standard parts and equipment will be furnished by many companies throughout the nation.

This new bomber is approximately five feet longer and has greater gross weight, which results from enlarging the horizontal and vertical tail surfaces. More effective fire power is provided by incorporating power turrets both on the top and bottom of the fuselage and a “stinger” turret in the tail.

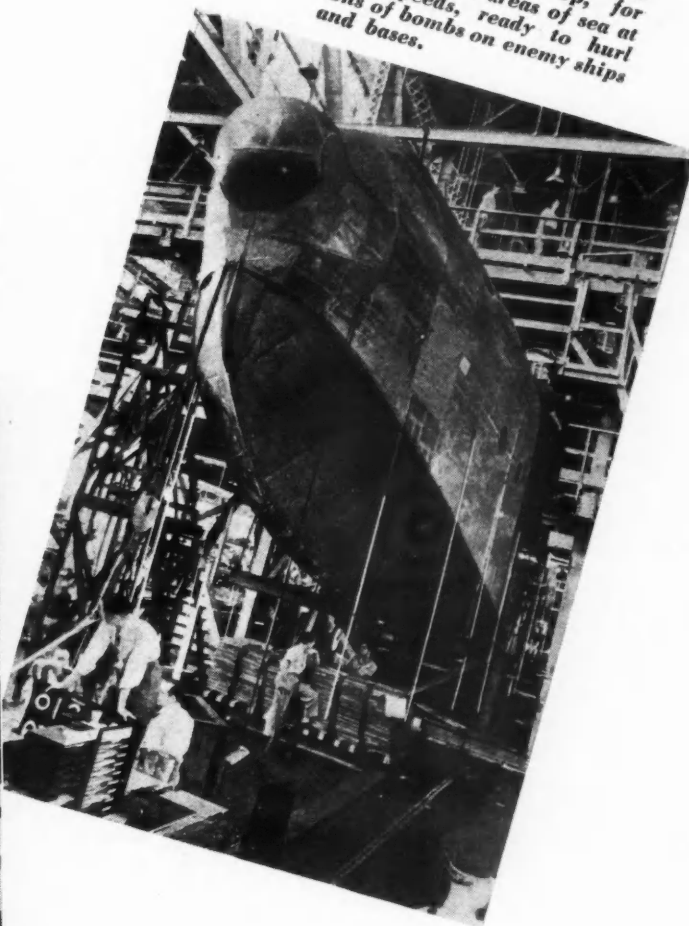
Comparable in size to the Army’s great B-19 landplane bomber, the Navy’s XPB2M-1 long range patrol bomber (photo on this page) is nearing completion at the Glenn L. Martin Co. plant, Baltimore, Md. Its wings spread 200 ft. from tip to tip, its two-deck hull measures 117 ft. in length, its normal weight is 140,000 lb., and it is to be powered by four 2000-hp. Wright Duplex Cyclone engines.



... present and future

The Navy’s 70-ton XPB2M-1 “flying battleship,” which is described at the top of this page, is shown undergoing engineering tests under hydraulic power loading in a 150-ton bridge-steel rig. Tests alone will cost \$100,000. It is designed for flying across the Atlantic Ocean and back again without a stop, for patrolling vast areas of sea at high speeds, ready to hurl tons of bombs on enemy ships and bases.

Many periodic inspections are made throughout the various manufacturing stages to insure proper assembly of parts. Here an inspector is measuring air pump rotor end clearances at the assembly department of the Eclipse Aviation Division, Bendix Aviation Corp., Bendix, N. J.



“Well, it did not do so well after the last war,” I can hear the readers exclaim. True, it did not do at all well, and the reason is that conditions during the last war and the present differed greatly; and next postwar conditions, in so far as they will affect our industry, are bound to be different from the last.

I want to dwell on that for a moment because I believe that it will give a fair picture of the industry



Spot welding of aluminum alloy assemblies on a new type of high speed welding machine at the Fairchild plant. This work was formerly done by means of riveting.

today and at the same time provide a glimpse into the future.

In July, 1917, there were fewer than a dozen airplane plants and most of them were very small and largely experimental. Nobody had any experience in operating under war conditions. They know little or nothing about subcontracting, the need for priorities of materials and labor; and they knew little or nothing about what was needed in the form of equipment. The reason that the manufacturers did not know was that the officials in Washington themselves did not know. Air warfare was too new.

The British and French Missions came over here to give us the benefit of their experience during the last three years and they immediately got into a bitter controversy among themselves as to what the United States should contribute. Months were lost, practically the entire balance of 1917, before the industry had any idea of what kind of a combat plane the Army wanted it to produce. The extent of the industry's experience could be gauged by its prior production, which had been an aggregate of about 300 planes in the last nine years prior to our entry in the war, and none of those planes was designed for combat.

Naturally the Government turned to the motor car industry for help; and naturally, too, it depended upon a very large number of automotive manufacturers and allied industry leaders to come to Washington and handle the aircraft production program.

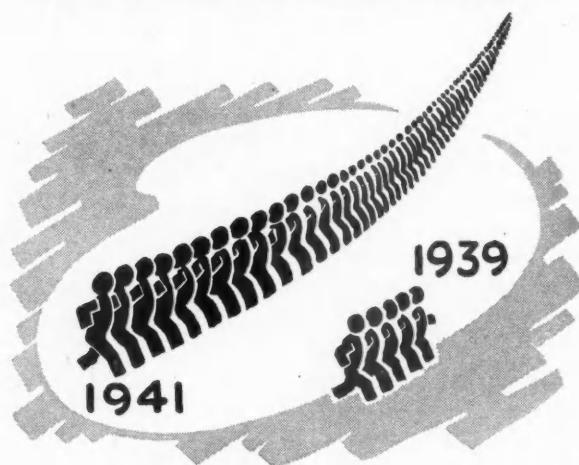
History has been repeating itself in that regard. The automotive industries have supplied a majority of the executives now in charge of the present produc-



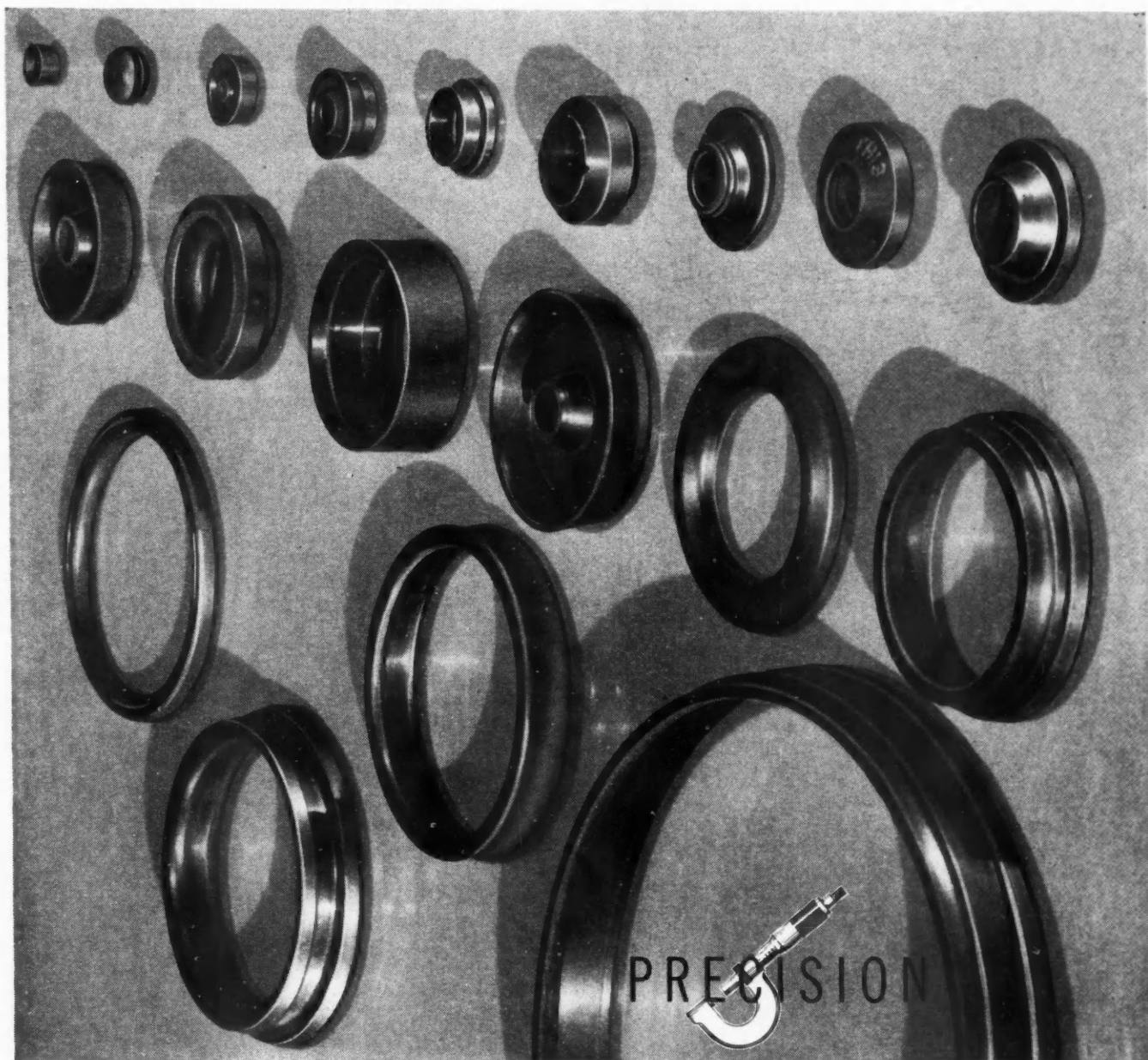
tion program. Also, the automobile industry has been called upon to augment the production of aircraft equipment supplied by the aircraft manufacturers. The difference between present conditions and those existing 24 years ago is that there are 24 years of experience to lend an impetus to the present effort.

One more fact about the past: Our participation in the last war was of comparatively short duration. Yet the American manufacturers had managed in that short time to gear up to a production rate which at the time of the Armistice was 21,000 planes a year. During the 21 months which was officially accorded as our war effort the Army received from American manufacturers a total of 13,894 airplanes and 41,953 aircraft engines, including spare parts for both planes and motors. Of those quantities

EMPLOYEES of Airplane, Aero Engine and Propeller plants since 1939 have been increased 500%



In 1939 airplane, airplane engine and propeller plants employed 60,000 men but have expanded so that 300,000 are on their pay-rolls today.



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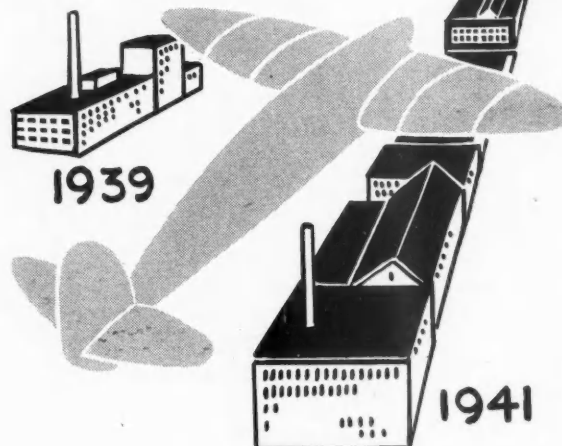
101

9742 planes and 14,765 engines came from the few companies which were classified as belonging to the aircraft industry. That was not all the production. They built for the Navy large numbers of airplanes, seaplanes and flying boats.

Further, the Allies had waged a steady campaign to have the American plants confine production to spare parts and other equipment which could be shipped to Europe and assembled there, and our manufacturers devoted considerable production to that phase of the program. One more point of interest: At the time of the Armistice we had in France or on the docks awaiting transportation, a number of American-built planes equal to the number which the central powers had in service at the time of the Armistice. We had 2091 planes in France and 1040 on the docks, and the central powers had 3309 planes in service at the end of the war. The statement has been made repeatedly and it has never been contradicted that the rapidly growing air power of the United States and Germany's knowledge of it helped materially to end hostilities.

I cannot lay too much emphasis on the point of experienced management. We have 26 plane, 10 engine and 5 propeller plants working on defense orders, and they in turn have let out subcontracts to hundreds of other plants in our own and other industries. Subcontracting would have been a most difficult procedure had manage-

AIRPLANE PLANTS
since 1939
have increased **375%**



In 1939 airplane plants occupied about 8,000,000 square feet of space. Today they cover 30,000,000 square feet.



An Air Corps representative of the Wichita area accepts delivery of the 2000th airplane manufactured by Stearman under the National Defense Program.



TRADE

AUTOMATIC

MARK

MANUFACTURERS FOR OVER 30 YEARS

Electric Propelled INDUSTRIAL TRUCKS

Fig. 10537-39. Heavy-duty Telescopic Fork Trucks stacking 10,000-lb. bundles steel plate after transporting from receiving. Lower view shows same truck servicing one of many Diesels with steel plates. Note how truck places load at convenient height to operator.



Fig. 10562. Operator withdrawing Special Skid Racks loaded with Crankshafts from Heat Treat Ovens. These are transported to storage and box-cars for shipment to assembly plants. Fork Truck illustrated is available in 3,000- to 7,000-lb. capacities.



Fig. 10541. One of the many efficient production jobs performed by "AUTOMATIC" 10,000-lb. High Lift Trucks. Truck illustrated facilitates general transportation and placing of Bundled Steel Plate at Presses.

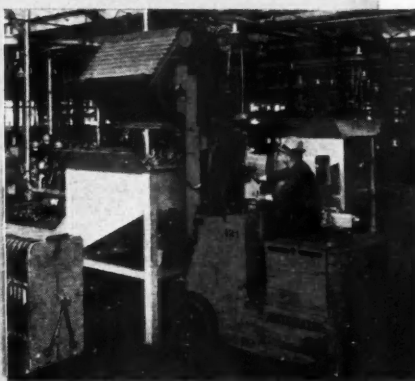


Fig. 10547. Special Motorized Revolving Fork Attachment built integral with Telescopic Fork Truck Lift provides efficient system for charging hoppers as shown with miscellaneous small parts as required for Water and Oil Pump Assemblies—also Valve Guides, Connecting Rods, etc.



MODERN PRODUCTION TOOLS CONTRIBUTING IMPORTANT ECONOMIES TO MODERN BUSINESS

• The "Electric Propelled" Fork Trucks, Die Handlers and Lift Trucks illustrated here are typical of the complete range of "AUTOMATICS" Time Proven Production Tools. These are offered to the Automotive and Aircraft and Metal Industry to facilitate improved handling methods and modern low-cost co-ordinated handling systems regardless of load 2,000 or 30,000 lbs.

Hundreds of these "AUTOMATICS" shown here are today operating in many modern plants in United States, Canada and Foreign Countries. They are vital factors twenty-four hours, day in, day out, contributing successful, dependable, economical, profitable materials handling, transportation and stacking. Each of these "AUTOMATICS" reflect the ultimate in Modern Design—Sturdy Construction—Greater Capacity Facilities—Increased Efficiency—Dependable Performance—Flexibility with Precision and Safety.

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AUTOMATIC TRANSPORTATION COMPANY

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Fig. 10554. One of the many production tasks performed by "AUTOMATIC" Fork Trucks is unloading unit loads of radiators from box-cars and transporting to storage and assembly.

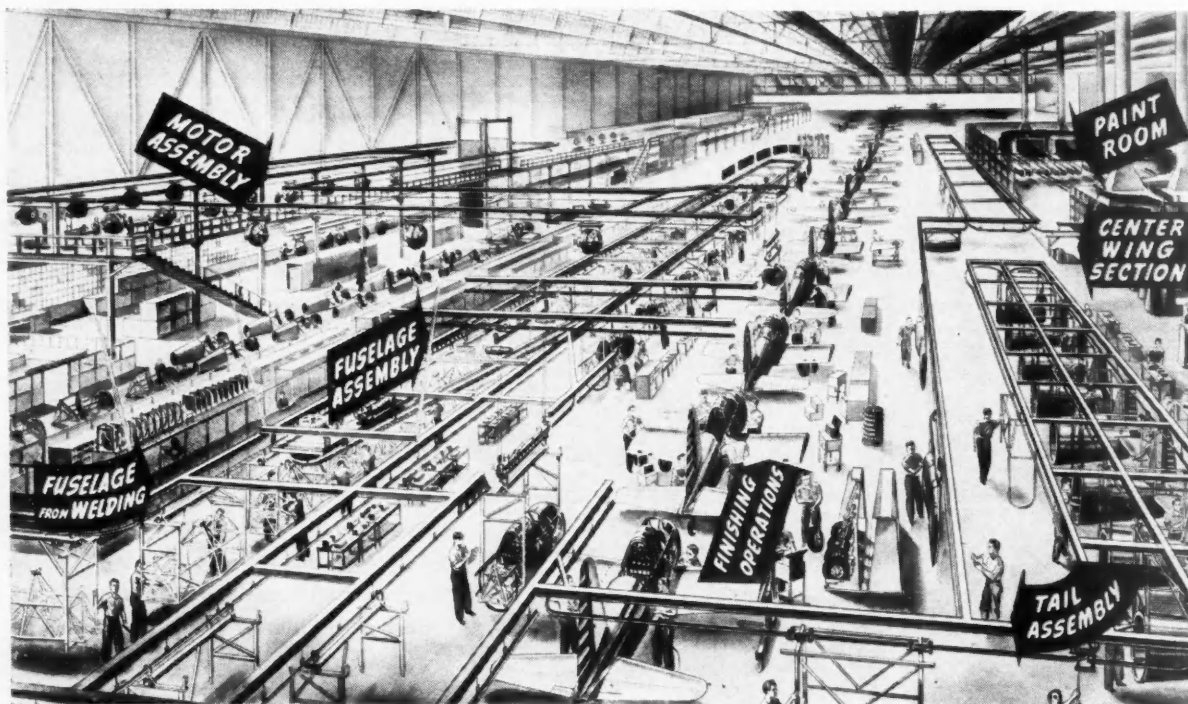


Fig. 10559. Unit load of steel plate blanks formed for rear axles being placed in production storage by "AUTOMATIC" Center-Control Fork Trucks. Capacities 3,000 to 7,000 lbs.



Fig. 10536. Heavy-duty "AUTOMATIC" Die-handler, 20,000 lbs. capacity. Fully equipped with latest motorized Die Loading and Unloading Platform to facilitate accurate Die Placing and efficient transportation to and from storage.

WHEN YOU BUY TRUCKS - - Buy "AUTOMATIC"



This illustration of the plant shows the mechanized final assembly at the California plant as it has been developed during the last few months. It is said to be the first mechanized assembly line in the aircraft industry.

Vultee breaks the ship down into five major units—fuselage, tail section, engine assembly, center wing section and outer wings. Conveyor lines reach out to bring all five together at the center of production as shown above.

At the right tail sections are assembled, complete with monocoque, stabilizers, rudders, elevators, and control cables, and move around on tracks to the center. Meanwhile, at the left, skeleton fuselages travel through assembly stages on a long U-shaped conveyor rail, winding up close to their starting point, complete with in-

struments, controls, canopies, wiring, etc. A short rail section then moves them across to the finishing line where they join the completed tail section.

The center wing section comes in at the right center from the fabricating and assembly departments. Meanwhile at the left on a balcony another assembly line is joining motor with engine mount and attaching controls. A chain driven overhead conveyor carries the complete engine assemblies to the center where they drop from a hoist to the planes below.

Farther down outer wings come through the paint shop to be attached. Beyond that point are stations for control adjustments and final inspection. It is claimed that this setup has increased the Vultee production fourfold during the last few months.

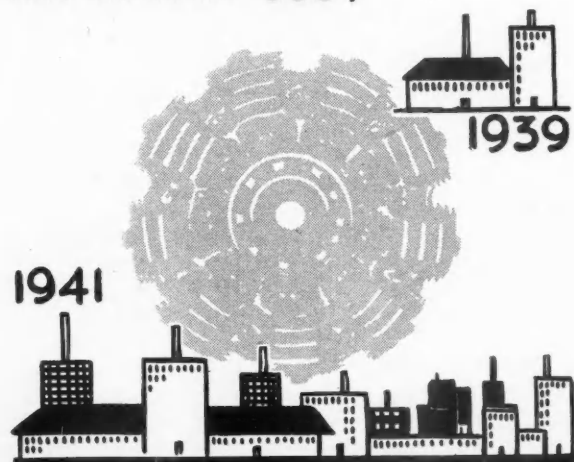
ment not been experienced in that phase of the business over the last decade.

Almost without exception the managers and other important executives of our plants are veterans of the last war, either in manufacturing or in the aviation branches of the defense establishment. They have been familiar with; indeed, they have played their parts in the development of aviation in all its branches. Manufacturers first inspired air transport development. They also carried on the campaign to provide airports, airways and all the other various developments that have contributed to the growth of aviation in this country dur-



The space occupied by airplane engine plants jumped from 2,000,000 square feet in 1939 until today they cover area of 10,000,000 square feet.

AERO ENGINE PLANTS
since 1939
have increased **500%**



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- 3 28" RAM ADJUSTMENT
- 4 UP & DOWN SPINDLE POWER FEED
- 5 3-WAY TABLE POWER FEED
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- 7 CONVENIENT CONTROLS
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To Aid You in Defense

• Here's a new universal vertical milling machine, a machine designed to meet the nation's defense needs. The large capacity and great versatility of the E. C. No. 5V makes its use applicable to the nation's arsenals, ship builders, aircraft manufacturers and the machine tool industry.

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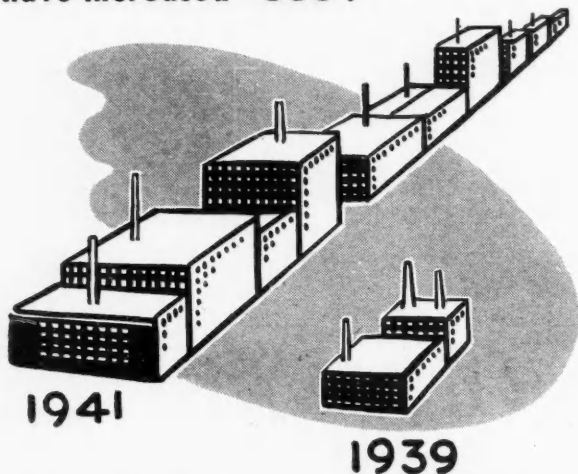
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1500 RAILROAD AVE. Established Since 1904 ROCKFORD, ILL.

PROPELLER PLANTS
since 1939
have increased **666%**



In 1939 propeller plants covered a space of 300,000 square feet, but since then have spread out over an area in excess of 2,000,000 square feet.

ing the last 20 years. So it is today that the manufacturers have been able to build up their production plant to proportions which only a few years ago would have seemed fantastic.

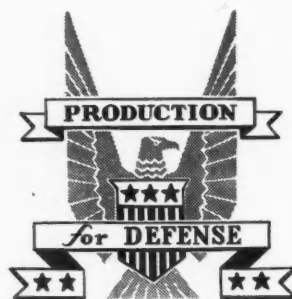
Before the outbreak of the war in September, 1939, the airplane plants had about 8,000,000 sq. ft. of space. They now have 30,000,000. The engine plants had about 2,000,000 sq. ft. of space, and now have more than 10,000,000. Propeller plants had about 300,000, and now have almost 2,000,000 sq. ft. of space. These three branches of the industry had a dollar production of \$225,000,000 in 1939. The figure for 1940 was about \$544,000,000, and this year, of course, it will be vastly greater, probably rising to more than a billion and a half dollars. I might put it another way by saying that during 1939 the industry was officially

recorded as having produced 2404 military airplanes including trainers, 5800 in 1940; and probably it will turn out 18,000 during the present calendar year. But those figures mean little after all. They do not tell the real story.

During one period of the present program emphasis was laid on quick production of trainers, and they were much easier to produce in quantity at the start. Unit totals mean nothing because a small trainer counts just as much as a 4-engine bomber. All types are important, of course, but in a military program progress in combat plane production has more significance because it is the measure of a nation's ability to wage a war. Officials in charge of the present program

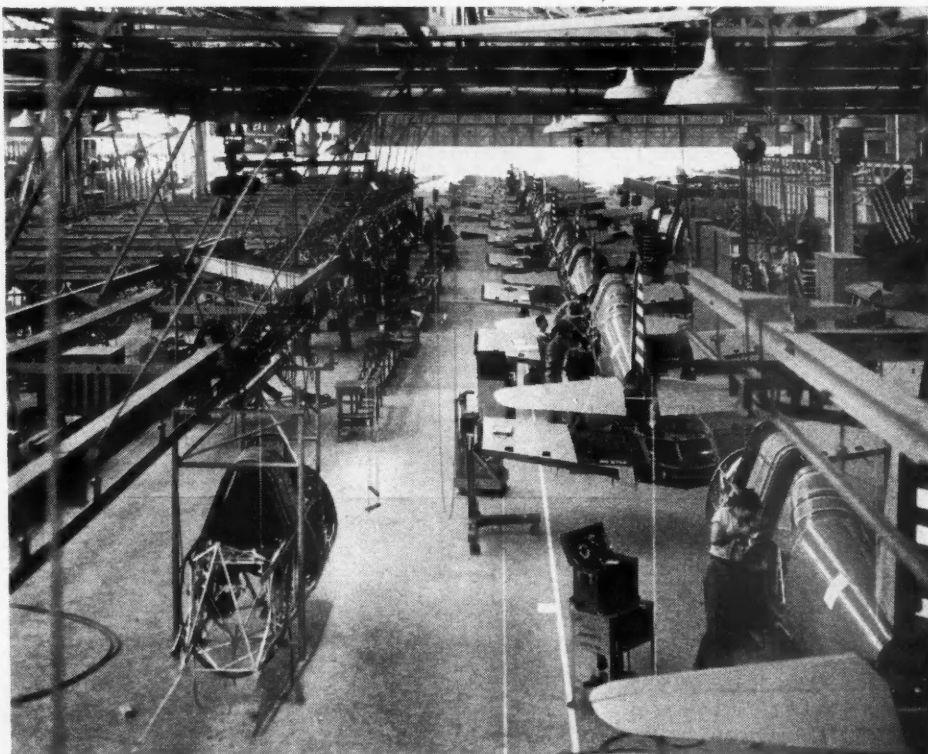
have expressed themselves as satisfied with the day to day progress that is being made in our output of combat planes.

Including the automobile industry and the Government assembly plants now under construction, the entire program now calls for approximately 80,000 planes; and that number may be increased



at irregular intervals from now on.

The plane, engine and propeller plants have increased total employees from about 60,000 in September, 1939, to more than 300,000 today. With the rise in employees, they have increased the number of manhours. They are now working at the rate of 52,000,000 man-hours a month. The program now in progress calls



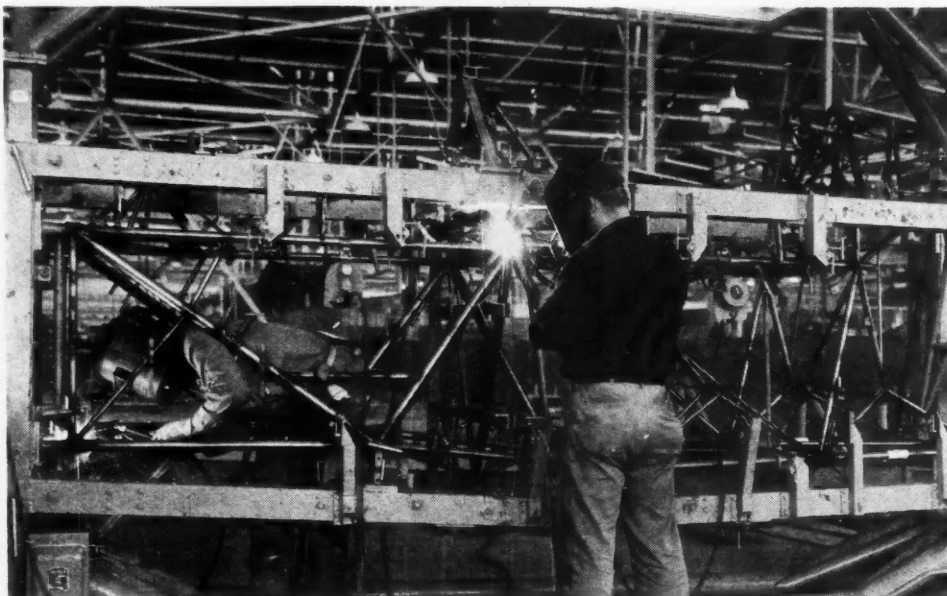
Looking down the final assembly line for Vultee Basic Trainers. Note the mechanized lines at the left and in the foreground at the right.

MEN *and* **Greenlee Automatics** **AT WORK**

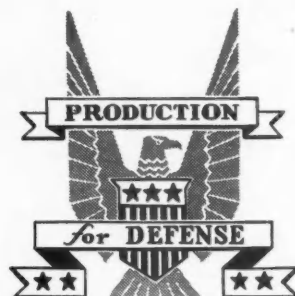


America is hard at work. Hard at work tackling the biggest job we've ever had to face . . . the job of outproducing any nation or combination of nations that may threaten our freedom. ● In the factories, shops, and mills, America's manpower is at work using all its ingenuity, skill, and energy to get this job of ours done and to get it done in a hurry. To help these men we're busy too . . . busy turning out Greenlee Automatic Screw Machines just as fast as we can build modern, efficient machines and do it right. ● Already hundreds of Greenlee Automatics are daily saving vital seconds in the production of defense parts. And when the emergency is over, these Greenlee Machines . . . machines designed and built right to stand the wear and tear of today's production . . . will be turning out ordinary peace-time parts just as fast and just as accurately as they now produce defense work.

ROCKFORD GREENLEE BROS. & CO. ILLINOIS
MULTIPLE-SPINDLE DRILLING, BORING, AND TAPPING MACHINES
AUTOMATIC SCREW MACHINES • SPECIAL MACHINERY



Fuselage frames for Vultee Basic Trainers are assembled by arc welding in this massive steel fixture.



for more than 50,000,000 sq. ft. of plant space as compared to the present 40,000,000 and more than a half million employees compared to the 300,000 today. None of these figures includes the aircraft equipment work of the motor car industry nor the accessories branches of the aircraft industry.

The availability of materials and labor, as well as labor conditions such as strikes, will determine the extent to which aircraft production will be speeded up next year. There may be bottlenecks caused by shortage of materials, shortages of finished parts or a dearth of labor in some sections. We may arrive at the bottlenecks in certain essential materials next spring. That will depend on how extensively other defense industries are called upon to use the same materials. The problem is one for the Government to decide, inasmuch as it is the Government alone which can determine how rapidly it wants each part of the defense program to proceed at any time. During one period it may be aircraft and shortly thereafter something else.

Much has been said and written about the part that the motor car industry can and should play in aircraft production. It is bound to be important and considerable. There are many reasons why motor car and aircraft industries are working together on this production program.

One of the most trenchant lessons of the last war was that an aircraft industry capable of supplying the full needs of a wartime air force is not possible in days of peace because of the economic hardships it would impose; and that being true, other peacetime industries must be utilized and diverted to war production. The motor car industry has been included in the industry's mobilization plan of the War Department since 1919. Last year when it was realized that this emergency would demand the utmost from all industries, the Government realized that if it should permit or force the regular aircraft industry to expand too far, the result would be disaster at the end of this conflict.

It was apparent that the huge plants and personnel available in the automobile manufacturing sections of the country could take up some of this aircraft work, and while thereby saving the aircraft industry from over-expansion, help keep its own shops at work despite restricted commercial car production.

The official planning agencies in Washington have done something here for which they should receive a great deal of credit. They have read the text and the lessons of the last postwar period, and they are doing their best to avoid a similar tragedy in this industry in the future.

DOLLAR Production of Airplane, Aero Engine and Propeller plants each year is growing over 100%



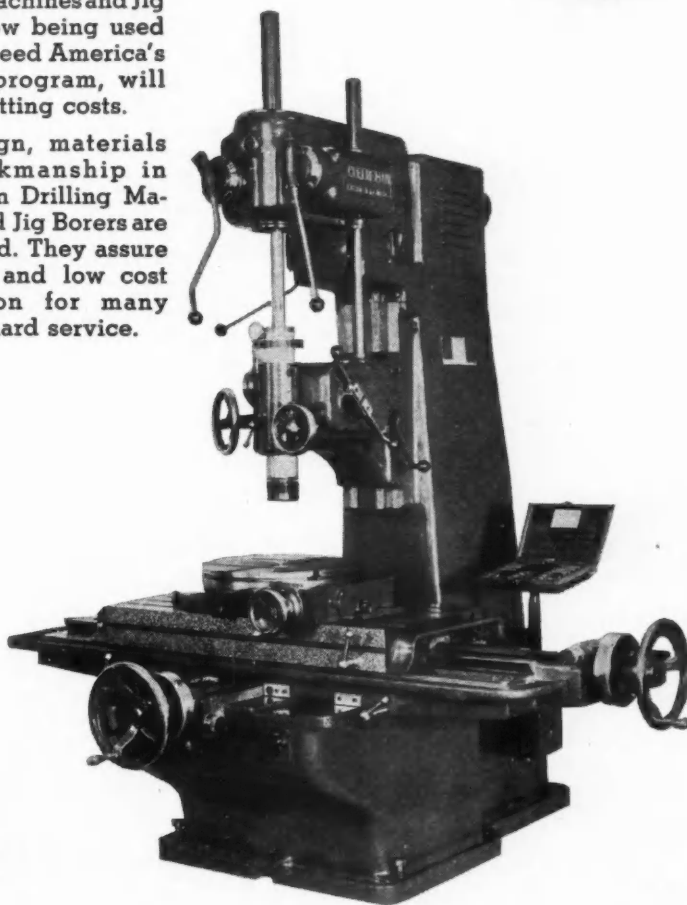
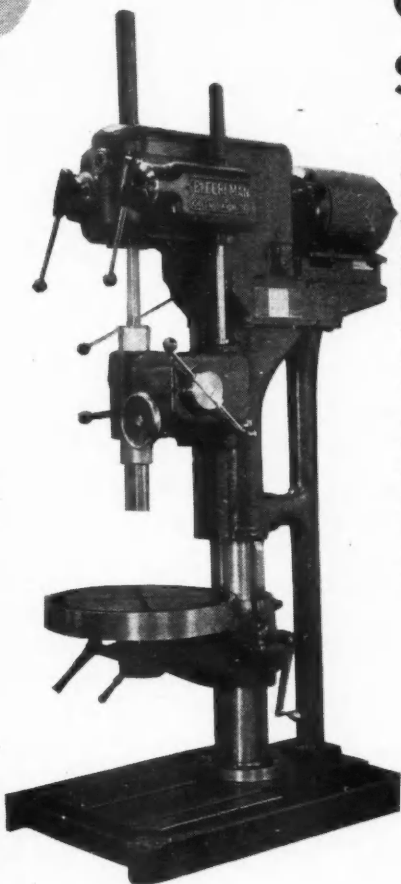
Airplane, airplane engine and propeller plants had a production totaling about \$225,000,000 in 1939 and \$544,000,000 in 1940 with an estimated dollar value of \$1,500,000,000 for 1941.

When Peace Comes ★

Cleereman Machines Will Still Be Cutting Costs

When the rush of rearmament is past, and the world has turned to peacetime work, Cleereman Drilling Machines and Jig Borers, now being used to help speed America's defense program, will still be cutting costs.

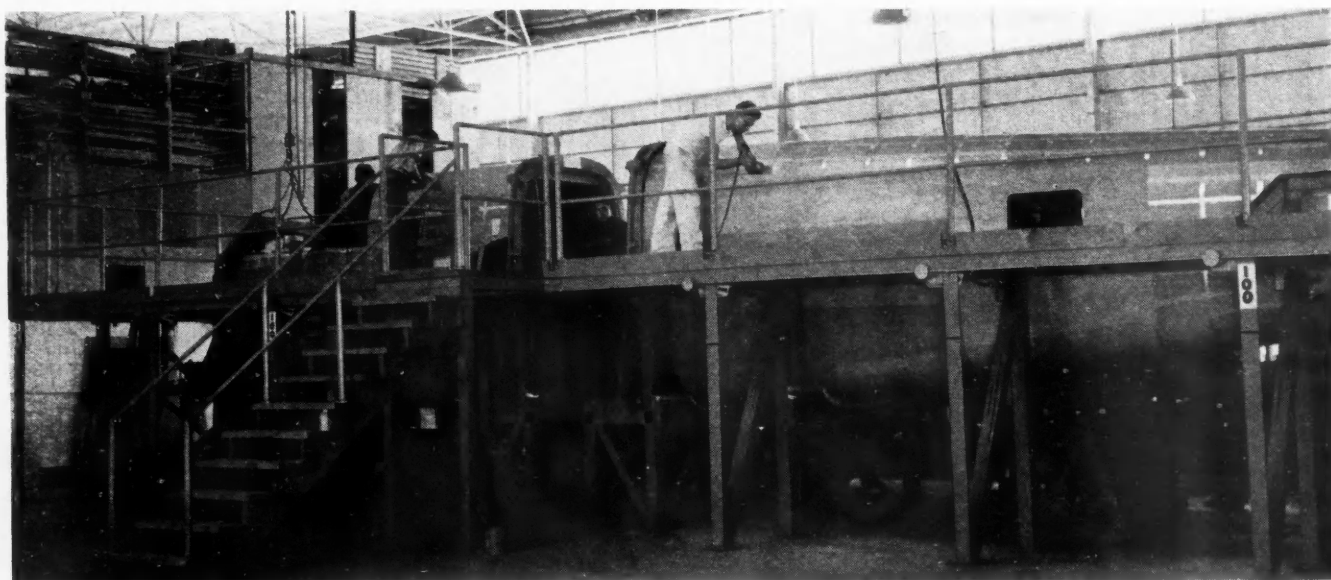
The design, materials and workmanship in Cleereman Drilling Machines and Jig Borers are unexcelled. They assure accuracy and low cost production for many years of hard service.



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CLEEREMAN

DRILLING MACHINES and JIG BORERS



This huge steel structure is a master fuselage jig for making up fuselage frames for North American Twin-engine medium bombers. Sub assembly sections are dropped into place by means of overhead hoists.

While the program of 1918 was small compared to the present one, its collapse on the signing of the Armistice serves as a danger signal. There were 24 aircraft companies in November, 1918. They represented a total capital investment of about \$23,000,000. They had been working on \$100,000,000 worth of military contracts. Within three days after the Armistice, all those contracts were cancelled. Within three months the industry had been liquidated to within 10 per cent of its war strength. Nobody wants that to happen again.

There are countless ideas being advanced as to how it may be prevented but the one thing sure is that the motor car industry and all the other subcontractors, by working on the production program today, will save the aircraft companies from a great deal of the over-expansion that will be dangerous when war production ceases.

There, too, is the problem of surplus military equipment, which prevailed after the last war, and which will be worldwide after the next Armistice. Thus far no comprehensive plan has been set up to provide against this surplus material being thrown on the world markets at almost nominal prices. That, of course, would make serious inroads on any post-war business. It almost reduced production to nothing in 1919. But here, too, conditions are different. At that time the military airplane was slow. In the absence of commercial models it had its uses commercially, regardless of the fact that it was usually an economic loss in so far as operations involving carrying payloads.

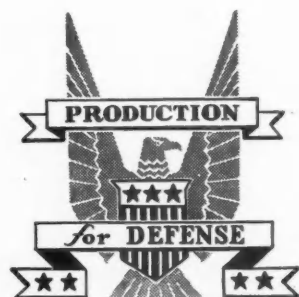
In the last several years we have advanced so far in the development of commercial planes, both for transport and for private flying, that they are now capable of being operated along economic lines. In other words, the operators after this war will want to buy machines that they can use at a profit; and I doubt that the military surplus sales will interfere seriously with that kind of business.

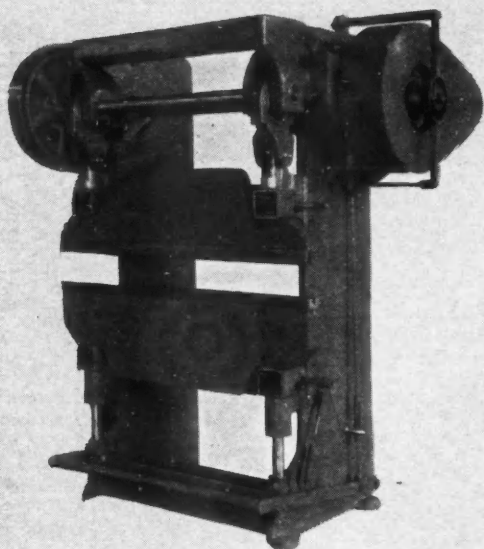
Whether or not the world will be in economic shape to buy airplanes of any description is another question and one which I will not attempt to answer.

There is another point. One is inclined to think of the end of a war as a time when all military production will cease. I do not think so. At the end of the last war only the aviation people themselves would admit that strong air forces are essential to national preparedness and the maintenance of peace. Such people being in the minority in every country found it extremely difficult to secure even small appropriations for the development of new aircraft and the purchase of sufficient numbers to provide a modicum of training.

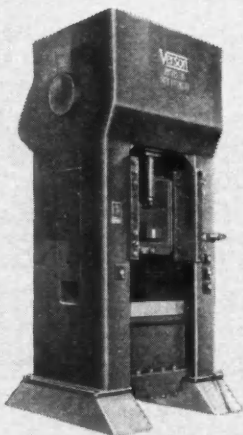
Our own air forces suffered most of all. In 1931 on a list of the six major air powers, the United States was fourth, surpassing only Russia and Japan by very slight margins. Germany was not listed because she had no military air force at that time. It is a sad commentary that in 1931 France had the world's largest air force with a fleet of nearly 5000 planes, both active and reserve. The fact that France did not maintain a strong air force and keep abreast of her neighbors, both in quantity and in quality, is one of the reasons that history will give for her present plight.

I may be optimistic to an extreme, but I cannot believe that any government official from now on, after what has happened in this war, will deny the imperative need for an adequate air force kept up to date both in personnel and equipment and of a size to guarantee protection against any potential foe. The established aircraft manufacturing companies, with long records of achievement in design and production, undoubtedly will find markets for their new machines, both military and commercial.





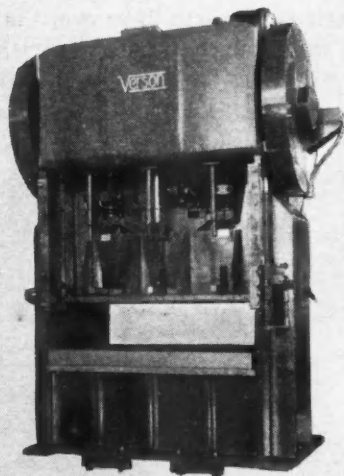
LEFT — Verson Junior Brakes are used throughout the aircraft industry. The machine shown is especially designed for the manufacture of aircraft parts. BELOW—Advanced designing of mechanical presses is symbolized by this 215 ton Verson Press.



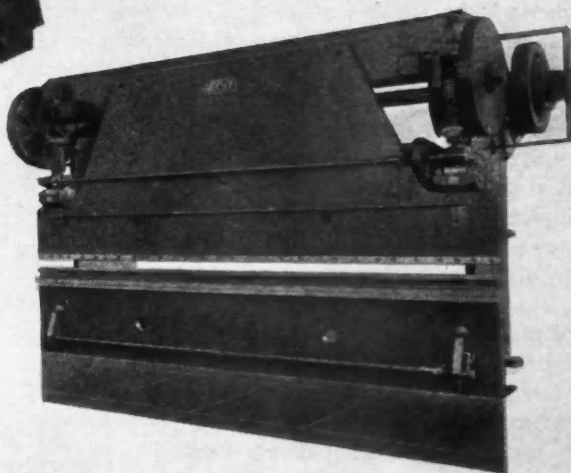
BELOW—Verson Two and Four Point Suspension Eccentric Type Presses may be had in capacities up to 5000 tons and liberal dimensional sizes.



ABOVE—Verson Double Action and Triple Action Hydraulic Presses include many revolutionary features. Capacities continue upward to 1000 tons in a wide range of bed areas.



LEFT — Verson Double Crank Presses are used extensively in the stamping and drawing of metal shapes. They are available in capacities up to 1000 tons. RIGHT — Verson Press Brakes range in size from 54" to 14 gauge to 50' x 1". They are ideally suited for multiple punching — notching — coping, as well as forming.



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THE VERSON Products illustrated here represent a typical cross-section of the wide variety of equipment available to the metal-working industry. Verson Presses and Press Brakes are in use by scores of automotive and aircraft plants throughout the country to meet all demands for clean, accurate work, versatility, long punch and die life, unlimited strength, and 24-hour a day dependability.

For a quarter of a century, this entire organization has devoted its ability to improvements in design and construction that have made Verson Products unsurpassed in their field. If you need additional equipment for hot or cold metal-working, get the facts about Verson Products now. Call on our Engineering Service to help in the solution of your problems. Take advantage of it without obligation.

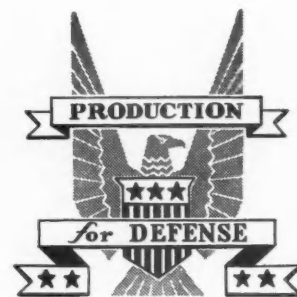
VERSON ALLSTEEL PRESS CO.

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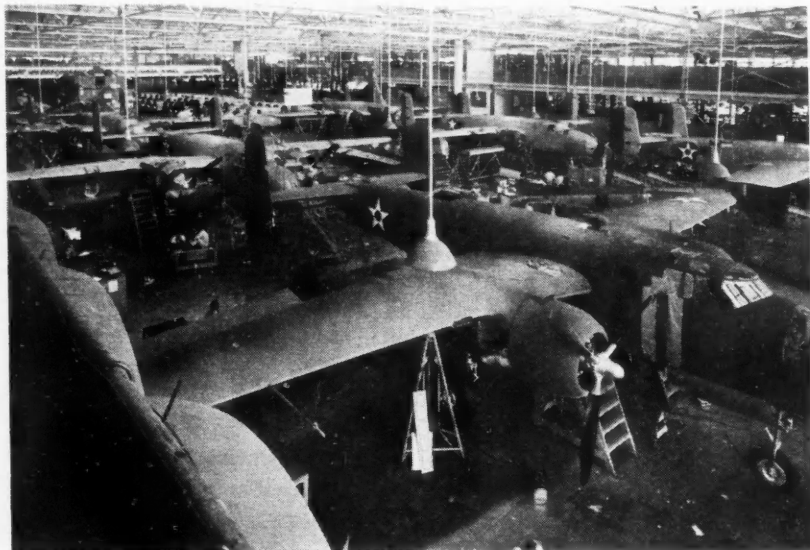
Originators of fabricated steel frames in the manufacture of Punch Presses

POWER PRESSES • HYDRAULIC PRESSES • CLUTCHES
FORGING PRESSES • PRESS BRAKES • DIE CUSHIONS

Automotive Manufacturing Methods Speed Defense Production



(Continued from page 53)



Partial view of the bomber final assembly floor at North American's Inglewood plant

panels made in very small quantities. This brought to the fore, dies made of zinc-base alloy, of rubber sections, etc. However, some of these techniques must needs be modified in conformity with auto-body practice due to the requirements of mass production.

Perhaps one of the major contributions of the automobile industry in the mass production of airplanes is that of materials handling. Some examples of the specialized conveyor systems in use in the large plants will be found in the pictorial section. Needless to say, although these conveyor systems are quite different in physical character they embody design principles which have proved so effective in mass production plants—for feeding parts, for final assembly lines, etc.

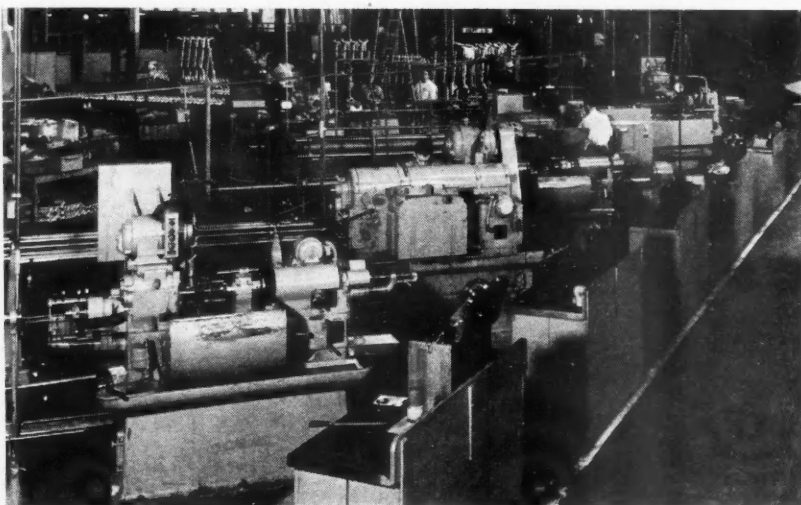
The pictorial section shows some of the fabricating methods and welding equipment uniquely suited to the problems of aircraft fabrication.

An excellent illustration of how

ing the component parts in the large quantities specified by the Army Air Corps.

Ordnance Materiel

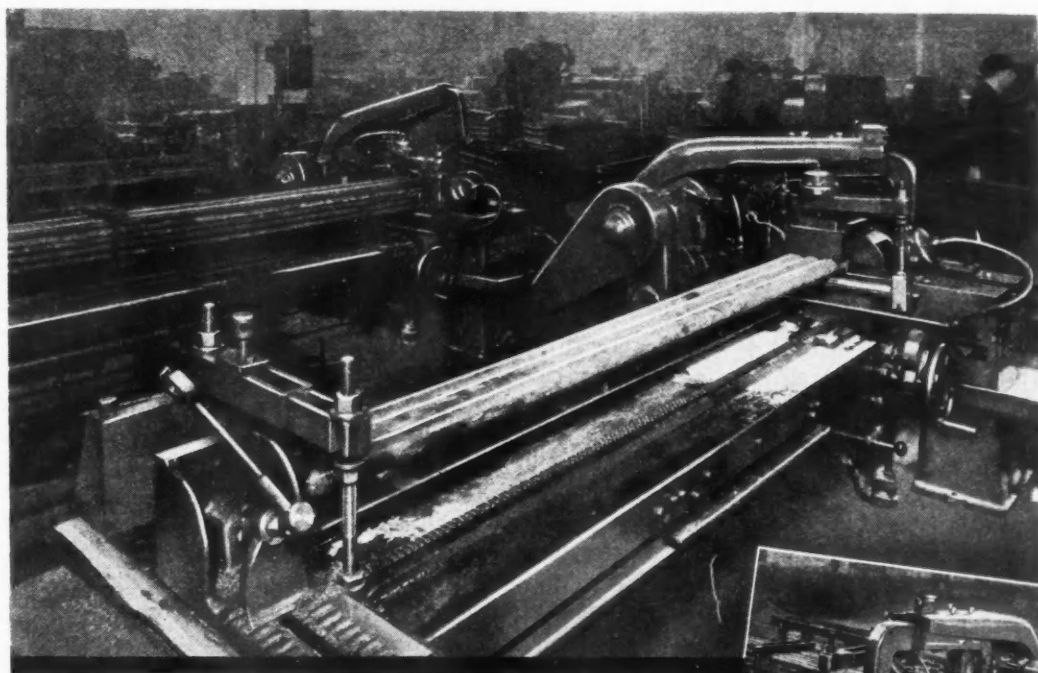
When it comes to items like machine guns, anti-aircraft guns, shells, cartridge cases, etc., which are being made in quantities hitherto unknown, the pressure of volume and the production-wise experience of automotive factory executives have combined to revolu-



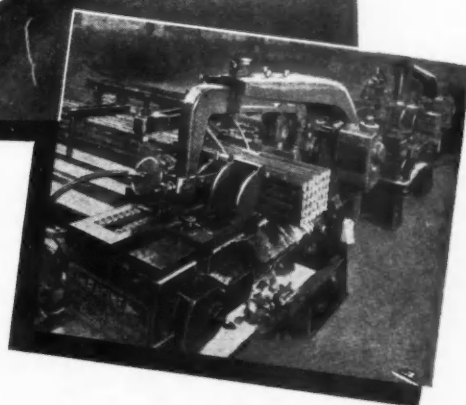
View of the automatic screw machine department at Vultee Aircraft. In the foreground are a Cleveland screw machine and a Conomatic

RACINE

PRODUCTION FOR DEFENSE WITH RACINE METAL CUTTING MACHINES



Modern industry is turning its peace time machinery into the production equipment of defense. The versatility of many machine tools such as the battery of Racine automatic saws shown above has permitted America in this emergency to tool up and get into production with a minimum of delay. For defense these Racine automatic saws are at work cutting off to accurate lengths all types of bar and billet stock for shells, tanks, motors, aeroplanes—everywhere in armanent industry. At peace these same saws keep down production costs in farm implement plants, in steel warehouses, in heavy industry of all sorts.



Smooth oil-cushioned power maintains fast production and reduces blade wear—rugged modern machine tool design means closest accuracy and longest life. For your cutting off requirements depend on Racine saws. Full line—from general purpose 6x6 to Heavy Duty Hydraulic Saws capacity 10x10 to 14x20.

RACINE TOOL MACHINE CO.

1005 CARLISLE AVE. ... RACINE, WIS.

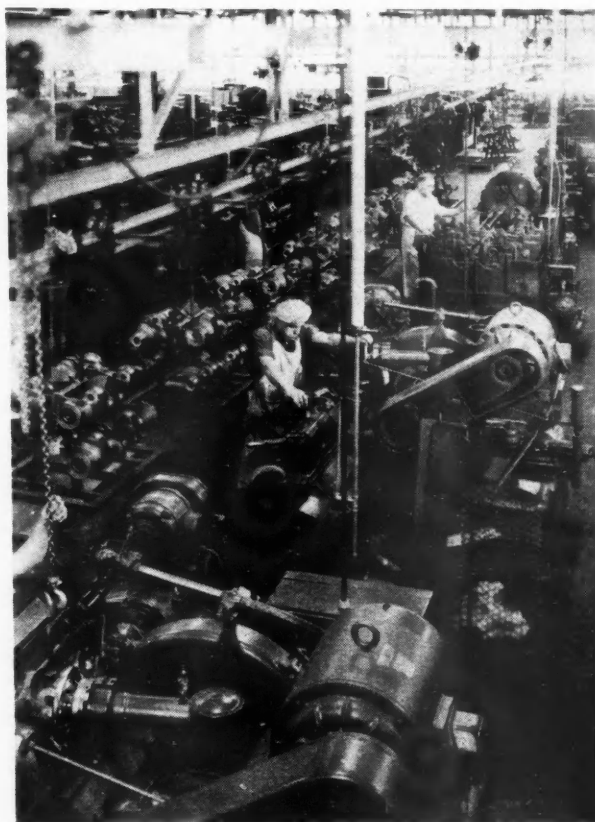
This crankshaft machining line in the Packard Rolls Royce plant is typical of automotive practice. Note the heavy duty monorail conveyor for transporting shafts from machine to machine and out of the department

tionize the art. It must be remembered that during several decades of peace time activity, the making of ordnance materiel has been the responsibility of the Army arsenals. Ordnance specialists have been developing and improving the design of weapons and ammunition, have been creating standards and specifications, but they have had little opportunity to experiment with new methods of manufacture, particularly in the field of mass-production.

Consider the experience of AC Spark Plug with its machine gun contract. At the start, experimental production and training of workers was done with old equipment salvaged out of the arsenal stores. But as the picture developed and as the skilled production men began to study the problem, they found many ways in which machine guns could be built quicker and better and at lower cost than ever before. Fortunately, in these initial studies, AC was encouraged and assisted by ordnance officers, permitted to make departures from established practice of long standing.

Out of this came some striking contributions adapted directly from automotive experience. One example was the introduction of the W. F. & John Barnes vertical, six-spindle rifle drilling machine which handles six barrels at a time and increases the output of barrels many fold. This was followed by a study of the application of Carboloy-tipped tools for rifle-drilling, promising not only a further increase in productivity but longer tool life and less interruption of machine output due to tool grinding.

Similarly, there came the introduction of the twelve-spindle, vertical, Baush rifle-reaming machines, de-



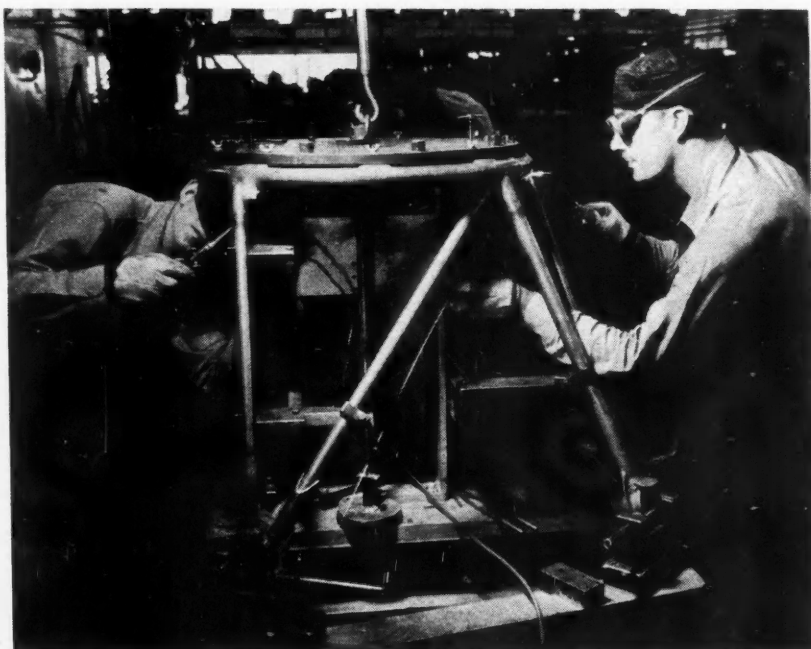
signed to expedite the reaming of barrels. Still another major advance was the development of a horizontal broaching machine by Illinois Tool Works, for barrel rifling by broaching. This procedure cuts the rifling time to but a fraction of previous practice.

Surface broaching has been adopted for a number of detail operations, greatly simplifying such operations. In addition, multiple-spindle drilling and tapping machines, heavy-duty milling machines, and other types of equipment familiar in automotive plants have been applied in an effort to speed output.

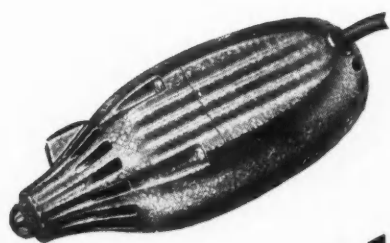
Materials handling is quite conventional, taken right out of the book of rules of the AC plant.

Another innovation is the use of Baird tumbling barrels lined with Neoprene for tumbling the small components of the machine gun to remove burrs and to break sharp edges. This eliminates the conventional practice of hand filing and grinding and polishing—again saving time and labor.

Budd and Olds furnish good ex-



Engine mounts for Douglas bombers are fabricated by welding with the oxy-acetylene torch. Note the massive steel fixture for positioning the tubular members, providing rigidity essential to an accurate assembly



DURO

POWER TOOLS

**PRODUCTION
BARRIER
SMASHERS!**



**TABLE, BAND and SCROLL SAWS —
JOINTERS — DRILL PRESSES — SHAP-
ERS — CARVERS — ROUTERS — FLEX-
IBLE SHAFTS — LATHES — POWER
and HAND GRINDERS — SANDERS —
ELECTRIC DRILLS — V-BELTS and PUL-
LEYS — MOTORS — ACCESSORIES**

When DURO Tools are on the assembly line there are no production barriers. Smooth, continuous production—that's what they give.

If the shops you call on need precision-built machines for fabrication of hundreds of small parts—if production barriers are cropping up due to lack of enough machinery—if big machines are tied up because they have to handle large and small jobs—the DURO line of Power Tools will fill the bill completely.

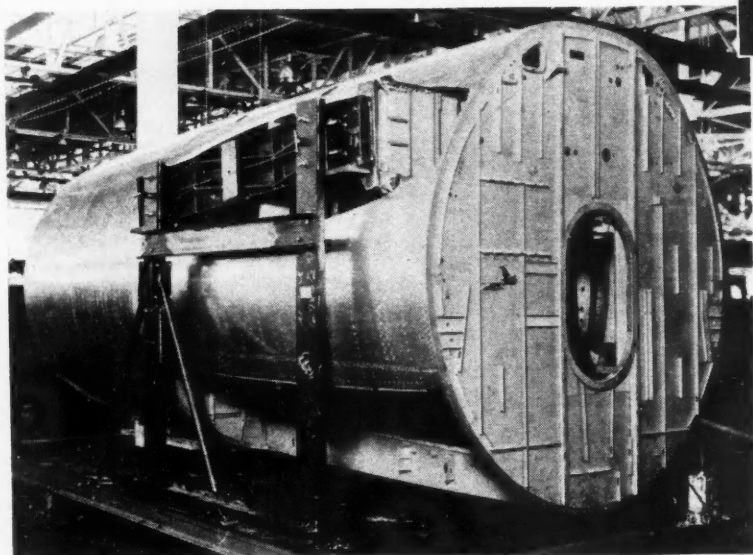
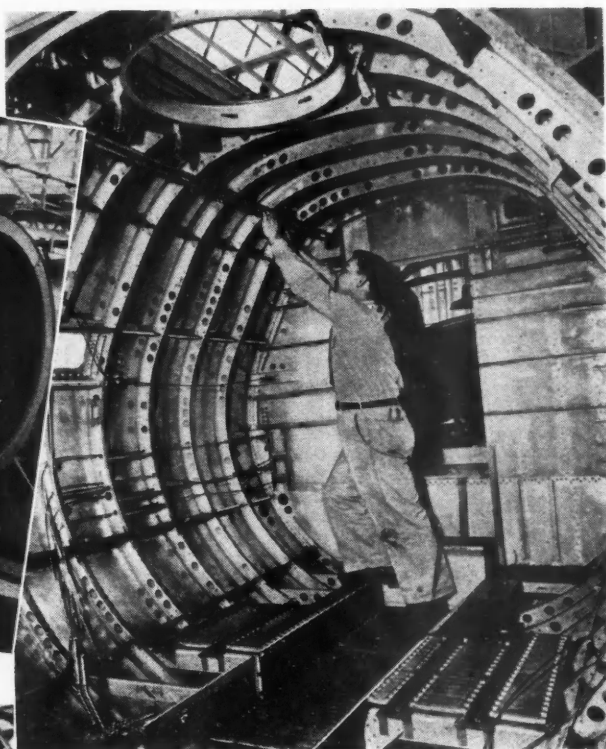
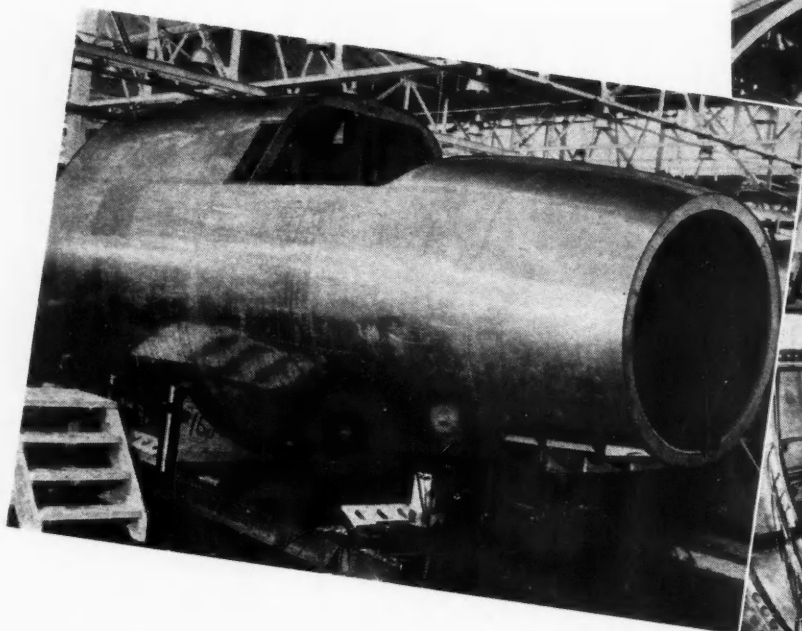
Modern design, precise workmanship, and finest material give that extra value which helps manufacturers to operate economically and efficiently. DURO Tools are comparatively low in cost and are being improved constantly to give the utmost in performance.

Our facilities, experience, ability, and buying power permit us to offer the very best in service on your orders. We would like to go into this further with you—Write!

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DURO METAL PRODUCTS CO.

2649 N. KILDARE AVE.
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The Chrysler Corp. is fast tooling up to speed the delivery of bomber fuselages to the Glenn L. Martin Co. in Omaha. There are 11,000 parts in the center section shown in the upper right view. The lower left view is of the outside of the center fuselage section while the upper left is a nose section

amples of advanced practice in making shells in huge quantities. Each one features modern production equipment familiar in automotive plants. Both use induction heating to speed up the heating of the billets — Budd

using its unique induction process, Olds using Ajax induction furnaces. At Olds will be found compact machine lines reminiscent of passenger car practice, with monorail conveyors for transporting billets to the forge departments, for transporting finished forgings to the machine shops, and through the machine lines.

At Olds the big shell forgings are cold-nosed on a huge press. This is probably the first time that the



cold-nosing procedure on large shells had a trial in production and it has worked out admirably.

The making of cartridge cases is an old art. In fact, the steps in the procedure remain unchanged even in mass production. But the equipment and the layout as it was developed at Guide Lamp, for example, are brand new and embody

a major forward step in productivity and quality. Here will be found the familiar Bliss and Toledo presses with multiple indexing dies, automatic lathes, Lindberg furnaces, etc. For large cartridge cases, they have installed huge hydraulic presses built by Hydraulic Press Mfg. Co. Materials handling has been worked out along the lines of automotive practice, making the department extremely compact and most efficient in the use of time and labor.

Another innovation is the removal of scale by sand blasting, using the Pangborn equipment so widely employed throughout the industry for cleaning forgings and castings.

The Bofors cannon, which will be built by Chrysler in its Highland Park plant, is typical of the way automotive mass production methods and analysis are being applied. Chrysler production men have studied the design and construction of this weapon in detail and have developed production methods calculated to

New MUNITIONS ENGRAVER

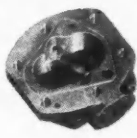
Simplified for FASTER Defense Production

MODEL
M-E

Ideal for
★ PRODUCTION ENGRAVING
★ PROFILING
★ Light MILLING
On Accurate Jobs Like This—



Gun Barrel letters and numbers engraved on steel—Time 5 minutes.



Plane Propeller Pump Housing, packing groove milled—Time 2 minutes.



Side Plate Support, profiled from engravers' brass—Time 5 minutes.



Graduated Section, lines, numbers engraved on curved plastic—Time 1½ minutes.



Martin Bomber Plate, figures 12 & 9 engraved on brass—Time . . . 15 seconds.

THIS NEW GORTON MUNITIONS ENGRAVER is simplified in design for rapid quantity production of precision munitions parts.

A PRECISION TOOL sensitive enough for wax engraving on glass and rigid enough for cutting in steel—furnished with a fixed pantograph reduction ratio of either 3:1 or 6:1.

SIMPLE TO OPERATE because all unnecessary controls and adjustments have been eliminated. A woman operator can be employed to relieve labor shortage.

MONTHS EARLIER DELIVERY than standard engravers—saves you valuable production time.

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ENGRAVER

\$ 650

F. O. B. RACINE
[Plus tax where required]

SEND TODAY for New M-E Bulletin No. 1635, containing pictures of other defense applications, production times and complete buying information.



GEORGE GORTON MACHINE CO.

1324 RACINE STREET, RACINE, WISCONSIN, U. S. A.

(Top) This tricycle landing gear enables the formidable P-39, the Aircobra, to hold itself in a straight line in take-off and landing runs

(Lower view) Tail Wheels as well as main wheels are retractable on high performance airplanes in the 250-275 m.p.h. class or above. This is the B-23, a medium bomber

speed up manufacture, and to tighten up on dimensional tolerances and surface finishes to an extent that promises a major reduction in the time required for the assembly of the cannon. In the process they will employ the latest types of machinery, quite similar, except in detail, to the equipment used in the automotive industry.

No matter what item of ordnance materiel has been undertaken by an automotive producer, its processing and treatment have been worked out along the lines of automotive parts production, utilizing equipment which has given a good account of itself in our industry.

Military Vehicles

When it comes to the building of military vehicles and bogies, the industry can point with pride to the performance of the Timken-Detroit Axle Co., whose engineers have worked with the Army for the past 20 years in preparation for the emergency. In consequence, axle design has been progressively improved and harmonized with the needs of military vehicles. Today, Timken has swung most of its production facilities to the making of axles and bogies for military use, and is building these products with the same methods and substantially the same equipment

as has been employed for civilian products of the same character. Perhaps the chief change lies in the fact that Timken has found it necessary to bring in additional equipment so as to increase its capacity.

In much the same manner, Spicer Mfg. Co., has turned all of

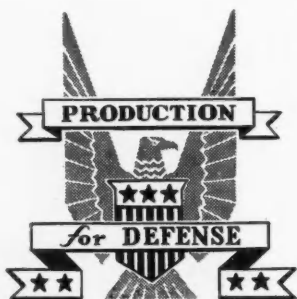
its facilities to the needs of national defense, making axles, light tank transmissions, half-trac vehicle transmissions and transfer cases, universal joints, etc. In the main, Spicer is employing its original equipment for the manufacture of defense products, supplemented with new tooling wherever required. However, in the case of the huge tank transmission it was necessary to acquire many new items of equipment such as the big radial drills, planers, and lathes.

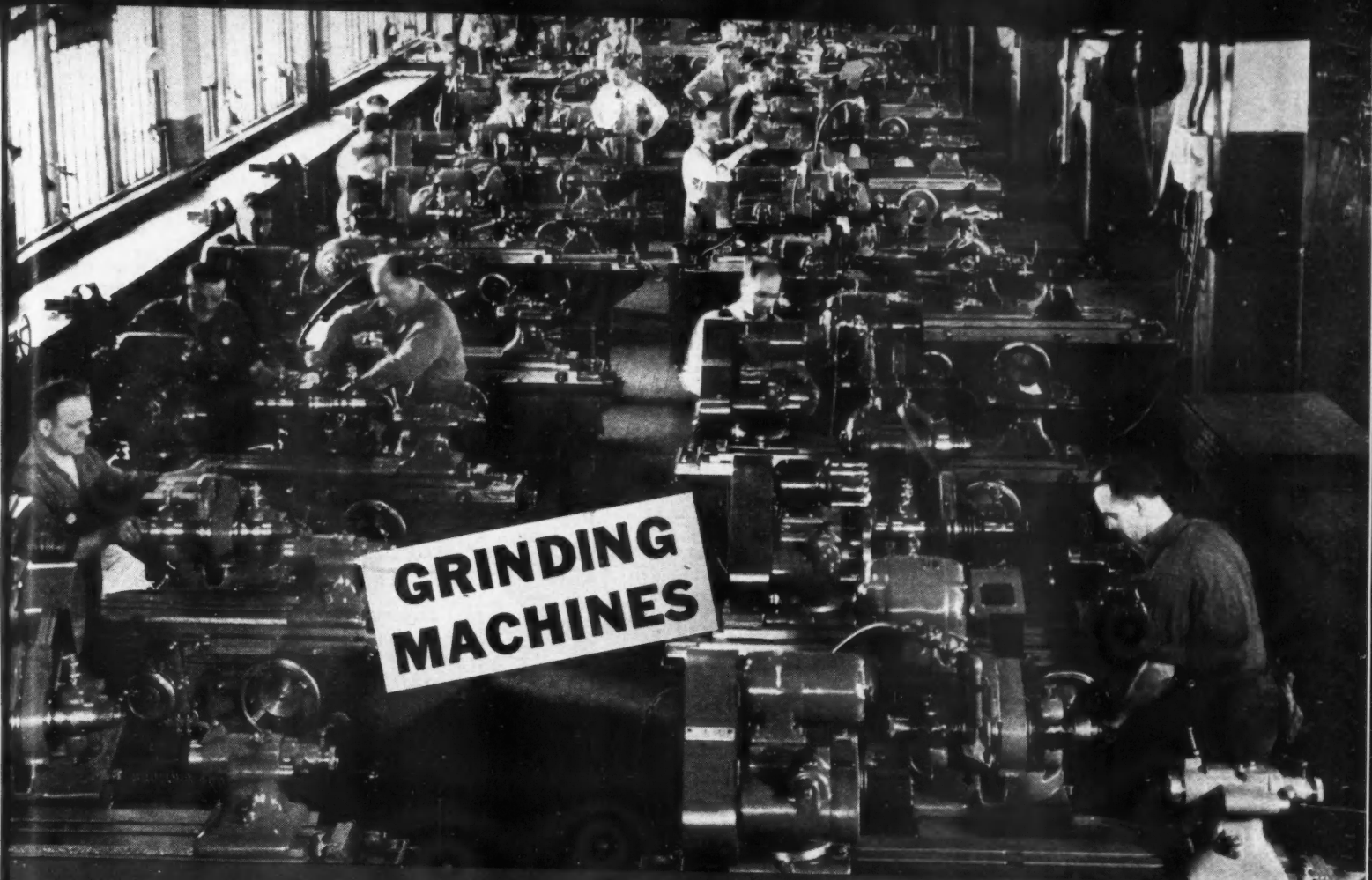
Eaton and other suppliers in this field also have taken on defense orders for products quite similar to their regular line of parts, thus making it possible for them to shift onto defense work without delay and without waiting for new machinery.

Miscellaneous Products

In addition to the components mentioned above, producers of the industry have undertaken the manufacture of many other products for national defense, including such items as—airplane wheel and brake assemblies, propellers, fuses, bomber frame parts, etc.

National Acme and Hayes Industries are among the





SHARPE

producers of airplane wheel and brake assemblies. The machining of components such as the magnesium wheels is done on conventional automotive equipment such as Bullard V-T-L's, Warner & Swasey turret lathes, screw machines, etc.

Materials handling methods and conveyorized assembly lines follow the pattern established in motor car building practice. Modern spray booth practice borrowed from automotive experience is found in the painting of wheel and brake components.

In machining propeller hub forgings, the producers have drawn upon automotive practice, using conventional tur-

ret lathes such as Gisholt and W & S, horizontal broaching machines, Cincinnati Hydro-Tel milling machines, and the like.

Summary

In conclusion, it may be said that automotive manufacturing practice has had the effect of dominating the picture of defense activity. Even a cursory examination of the methods and equipment employed in the production of defense items of the kind we have touched upon reveals machinery made familiar in motor car plants throughout the industry. It is safe to say that the availability of such equipment and the

development of specialized techniques have been responsible, in the main, for the rapid expansion of defense work and for the relative ease with which the weapons of war have been tooled for mass production.

By the same token, many of the new developments in machine shop management resulting from the defense effort will constitute the base for the advanced practice of the future. In this respect, the current activity will have its effect upon improvements in automotive practice after the emergency is out of the way.

We Need Our Automobiles More Than Ever Now

(Continued from page 77)

Superimposed upon this tremendous and vital customary usage of automobiles all over the United States, comes finally the emergency load occasioned by the program of national defense.

The inter-plant conveyor system of "the national factory" crawls along relentlessly, over the highways, night and day. Workers, changing shifts at defense plants, clutter up the highways. Military maneuvers, involving troop movements over considerable distances, require exclusive use of certain routes for many hours at a time—and, Boy, how they do tear through those villages and towns!

But this is only the beginning.

Director General Knudsen, of the OPM, predicts that "we shall hit the peak of production by next July." But John D. Biggers, Minister to London in charge of synchronizing British and American defense production, says "There is no such think as a production peak . . . there is always a peak beyond and higher than the one you have just climbed."

What you may see today, therefore, as perhaps merely a tendency to increased traffic on many highways, and a growing congestion at bottlenecks, will be greatly intensified in months to come.

What you may recognize as a necessary defense measure, when it comes to curtailment of passenger car production to liberate materials needed for war-time uses, will become a critical handicap to the life of the community, if priorities are not granted also for new vehicles to replace those worn out in service, and for the necessary parts and accessories for passenger cars. Curtailment of new vehicle production involves more service from those vehicles which cannot be replaced, but must be made to run farther and do more work.

It is not a case of guns or butter, but of guns and bread and milk, and also of men at work.

These postulates would seem to be worth keeping in mind as the days go by:

(1) The widespread use of automo-

HOW MACK TRUCK GOT 72 CARBOLOY TOOLS 6 WEEKS FASTER!

Standard Tools Quickly Adapted To "Specials" In Mack Tool Room

International-Plainfield Motor Company, Plainfield, New Jersey, well-known manufacturers of Mack trucks, buses and fire apparatus, needed 72 Carboley tools FAST . . . to bore two types of cylinder blocks.

Each tool was a special. Ordinarily that means a long period of waiting for deliveries under present conditions.

But Mack didn't wait! Instead they checked Carboley Standard Tool specifications . . . found that their special requirements could be quickly adapted from Carboley

standards. The above sketch shows three examples. The solid lines represent the tools they needed. The dotted lines show the Carboley Standard Tools they ordered. Into Mack's tool room went these standards—to be quickly adapted to the special shapes required—then onto the job weeks ahead of the time required for delivery of specials.

May we help you get the same fast results? You always get standards faster than specials . . . and they are adaptable to 60%-80% of all turning, boring and facing jobs. Send for Catalog GT-129.

For Emergency Jobs
Bore Your Own
When a job must get under way fast—bore your own tools.

It's a simple, fast, three-step process. Get the facts. Write for booklet GT-133.

Style 100 Style 200
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of new anti-aircraft defense unit pick up sound of plane miles away, catch plane in brilliant beam of light; mechanical "brain" flashes plane's position to gun which fires with deadly accuracy. Searchlight equipped with U. S. Tires; power, communication and control by U. S. Rubber insulated electrical wires and cables.



PHOTO BY U. S. ARMY SIGNAL CORPS

Quality tires save rubber... vital to national defense!

Quality tires give longer mileage, use less crude rubber per mile.

Thus, the user of quality tires is conserving both his own and his country's resources.



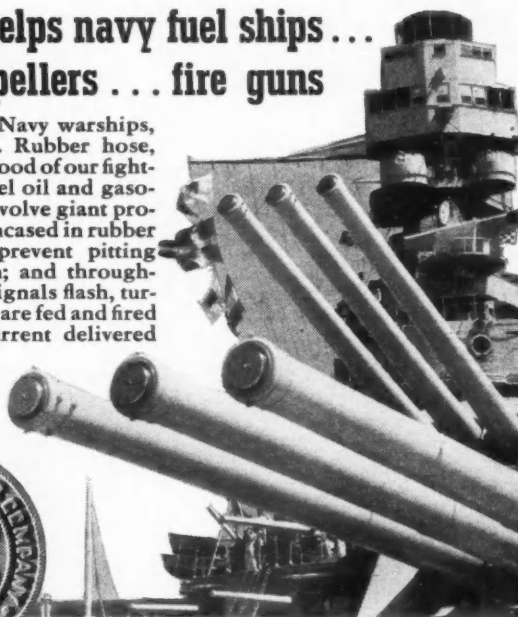
PHOTO BY U. S. ARMY SIGNAL CORPS

Rubber tubes for gas masks...

Non-kinking, tough U. S. Rubber tubes in new type gas masks protect soldiers from gas attack; insure free flow of air at all times.

Rubber helps navy fuel ships... turn propellers... fire guns

Aboard U. S. Navy warships, through U. S. Rubber hose, flows the lifeblood of our fighting fleet... fuel oil and gasoline; below, revolve giant propeller shafts encased in rubber sheaths that prevent pitting and corrosion; and throughout the ship, signals flash, turrets turn, guns are fed and fired by electric current delivered through U. S. Rubber insulated wires and cables.



OFFICIAL U. S. NAVY PHOTO

UNITED STATES RUBBER COMPANY

6600 East Jefferson Avenue, Detroit, Mich.

October 1, 1941

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123

biles represents neither a popular whim nor a passion for extravagance, but the growth of more than a generation of changing modes of living in this country.

(2) Reversing the previous trend toward urbanization, the population movement of the past decade has been toward the suburbs. Many rural sections are becoming more thickly populated. This trend is predicated on the service of the motor vehicle.

(3) By contrast with the inherent economy of the private motor vehicle and the free delivery, which is an accepted part of many business operating costs, a return to public street trans-

portation would now be cumbersome, costly, unprofitable and highly impractical.

(4) So-called necessity driving will increase with the intensification of the defense program, especially in view of the redistribution of work and wages.

These things being so the normal or free use of motor vehicles can neither be conveniently ruled out, nor even seriously repressed by fiat, no matter what impulses may lead that way.

Considering the popular power of resentment against all forms of prohibition, the rule of special war-time restraints upon automobile usage—if any is really necessary—must be a rule of

reason. Otherwise evasions and violations will multiply beyond police powers of suppression.


Statistically the automobile represents only one-fourth to one-fifth of the population. Politically it is both a symbol of luxury and a non-voting, or safe tax base. Practically it is a domiciliary adjunct of the common or working citizen, which, in his own view of his rights and liberties, is absolutely necessary to him, as long as he can reconcile the cost of owning and running it with his family budget. And he is an adept at that.

Creosote as a Blend for Diesel Fuels

The possibilities of creosote as a blend for petroleum-base Diesel fuels—in order to stretch the supply of the latted—have been investigated in England, and a report on the results obtained was made in a paper by W. Allen, works manager of the Rochdale Corporation Passenger-Transport Department, read before the Institution of Automobile Engineers. Creosote is a by-product of gas works, and before the war it sold in England at between 7 and 8 cents per U. S. gal. There are essentially four grades of creosote oil, which are derivatives of four different types of coal tar, and they differ chiefly with respect to the proportion of naphthalene contained. The latter is a solid hydrocarbon which is soluble in creosote to a limited extent, depending on the temperature. When petroleum fuels are blended with creosote, gumming and sludge formation are likely to be experienced, and to minimize this trouble the creosote should not be less than 30 per cent.

It seems that the sludge formation is due directly to the presence of tar oils in the creosote, and to minimize trouble from sludge, the creosote may be washed to eliminate the acids. Specifications were given for crude creosote and washed creosote, respectively, and showed that while the crude contained 25 per cent of tar acids, the washed creosote contained only 4 per cent. Washing, however, reduces the total amount of creosote available by about 25 per cent, and increases the cost materially. It also affects the distillation characteristics, the crude having an initial boiling point of 230 deg. Fahr. and an end point of 650 deg., while the washed product had an initial boiling point of 360 deg. and an end point of 640 deg.

Starting the engine cold was more difficult with the creosote blend than with gas oil, but the maximum power output was about 3 per cent greater with the former. On starting cold, the creosote blend gave an exhaust in the form of a dense white vapor. With the unwashed creosote there was some complaint about the exhaust causing smarting of the eyes, which ceased when washed creosote was substituted.



DETREX METAL PARTS
Washers
**ENGINEERED
TO YOUR NEEDS**

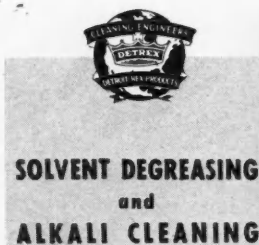
No matter what your cleaning problem may be . . . inter-process or final cleaning . . . the removal of drawing compounds, oil, salts, caked-on soil, etc. . . or whether alkali solutions, caustic strippers, petroleum spirits or the new emulsion cleaners are used . . . a Detrex washer can be engineered and built to meet your needs.

Our long experience in the manufacture both of washers and a complete

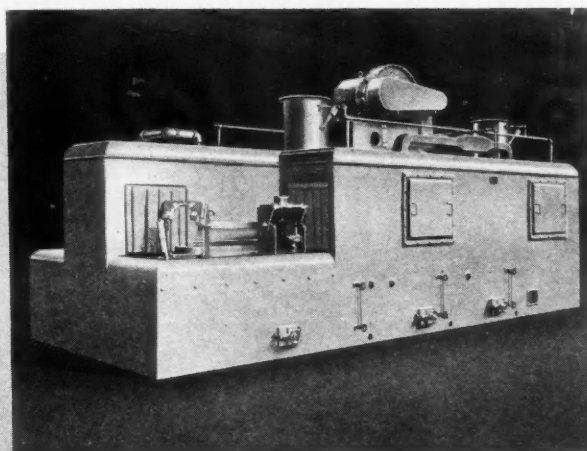
line of cleaning materials . . . together with our modern research laboratories and large engineering staff . . . always assure you of efficient, safe and well-built equipment. Write for complete details.

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Right: Multi-stage spray washer with special tilting fixtures on conveyor. Used in the cleaning of Aircraft engine cylinders.



The Breakdown of Britain's Civilian Highway Transport

(Continued from page 71)

statistics for 1940 indicate that approximately 32,500 passenger cars and chassis were exported (compared with 70,000 in 1939), and 6500 commercial vehicles (11,500 in 1939), the majority of the latter being light van chassis.

These figures for 1940, however, relate almost entirely to production completed before the Dunkirk evacuation. During the elapsed months of 1941 export is said to have been insignificant and connected either with the war effort or with essential needs of civilian populations overseas. As regards the value of automobile exports, it has been estimated that since the outbreak of war, motor vehicles to the value of roughly 9¼ million pounds sterling have been exported, the corresponding figure for components and accessories being 4½ million pounds, with another 4½ million in respect of tires.

In July of this year it was announced that certain manufacturers of small cars—Morris, Austin and Ford among them—had been authorized to produce a further limited number of 8 hp. and 10 hp. models, for sale under permit in the home market to persons engaged on war work of vital importance, such as doctors, inspectors of airplane production, and the police. Similar arrangements have been made in respect to truck and bus production and sale, and it may be mentioned that in all cases applicants for a permit must not only give good reasons why they should have one, but must also specify at least three makes which would suit their purpose.

From the foregoing it will be realized that production of passenger cars for the domestic market practically ceased in July of last year. Curtailment of production was initiated by reason of the slump in demand at the outbreak of war; in some plants production continued on a 10-20 per cent basis until stocks of materials were used up. The first "official" control of production was when the Ministry of Supply agreed to release enough material for an output equal to about 10 per cent of normal, to be devoted almost entirely to export. At the time of writing there is a far greater potential home demand for both small cars and trucks than the authorized scale of production, notwithstanding the fact that the purchase tax on cars now adds roughly 25 per cent to the list price, the latter much increased since 1939.

Up to the present there have been no war-time restrictions on the use of civilian motor vehicles in Britain, beyond that imposed by the rationing of fuel, which applies to both gasoline and

fuel oil. Lubricating oil is not rationed, and though a scheme was prepared over a year ago for the pooling of the products of various manufacturers and blenders, as in the case of gasoline, it has not been put into effect. "Pool petrol," introduced in the very early days of the war, remains the only kind of gasoline available to civilians, and though at first its quality was widely criticised, improvement is now generally admitted. The basic ration for private use and the supplementary rations for essential personal transport have both

been cut recently, the former by one-sixth (bringing the maximum monthly mileage down to 120-150), while supplementary rations have been reduced by from 5 to 50 per cent. A detailed report of every journey made with supplementary gasoline is now required before a further allowance is granted.

Although the curtailment or cessation of automobile production in 1939 resulted in many plants being more or less idle for a while, it was not long before they were brought into use again for the production of munitions.

Hydraulic Power Unit for Clutch or Brakes

Hydraulic power units for operating the clutch or brakes on heavy trucks, tractors and buses are now being produced by Vickers, Inc., Detroit, Mich. These units are suitable for use wherever such controls require power operation in one direction only and are normally either spring released or applied. Each unit constitutes a booster cylinder with a single-acting manual control operating through a servo valve to actuate hydraulically a control rod. Two booster units may be connected in series and operated from a common power source, so that they may be operated simultaneously or individually. When so connected, the operation of one in no way affects that of the other. The unit may also be operated in parallel with a Vickers hydraulic steering booster unit. These hydraulic power control boosters are normally operated by Vickers rotary vane pumps.

The booster cylinder has a diameter of 1¾ in. and may be operated at pressures up to 300 lb. per sq. in. At this operating pressure the unit will develop a thrust of approximately 600 lb. A stroke of 1¼-in. is normally provided. The rod extensions, which are protected by flexible boots, are provided with a ½-in. N.F. thread. The unit is designed for manifold mounting against a suitable pad or bracket secured to the machine frame. It in-

corporates an over-load pressure-relief valve, and no external pressure protection is required. When the control boosters are not in operation the hydraulic fluid is circulated freely, so that there is no material power loss.



Effective Nov. 1, **Russell B. Day**, now Southwest district manager of Wico Electric Co., will become assistant manager of manufacturing sales, and **R. W. Wilbur**, now assistant service manager, Southwest district manager.

Philip Linne has been appointed sales promotion manager of Owens-Corning Fiberglas Corp. **W. D. Thackeray** has been named advertising manager to succeed Mr. Linne.

John Brooks, assistant production manager in charge of customer contacts for AC Spark Plug Division of GM, has been loaned to the British Purchasing Commission as an adviser on planning and production.

William H. Mason has been appointed director of public relations for General Tire & Rubber Co. He was formerly with the Detroit office of the New York Times.

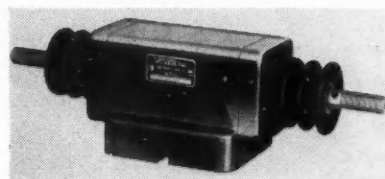
C. A. Ohi, formerly director of sales and engineering of Bendix-Westinghouse Automotive Air Brake Co., has been appointed assistant general manager; **A. Vance Howe**, manager of manufacturers' sales and **A. J. Bent**, manufacturers' sales representative.

George L. Randall has been appointed advertising manager of Wickwire Spencer Steel Co., following the resignation of **K. A. Zollner**, advertising manager of the company for the past 15 years. Mr. Randall was formerly asst. advertising manager of G. Schirmer's Music Publishers.

W. G. Prasse, formerly Eastern representative, has been appointed sales manager of Oilgear Co.

Appointments of four executives for The Glenn L. Martin-Nebraska Co., the new wholly-owned subsidiary which will operate the new aircraft assembly plant at Omaha, Neb., are as follow: **Herman G. Klemm**, chief engineer; **William O. MacArthur**,

(Turn to page 168, please)



Vickers hydraulic clutch or brake booster

Automotive MATERIALS

56

Wool Felt Applicable for Vibration Isolation

To prevent the transmission of vibrational energy from a machine into its base, wool felt is quite effective within a low loading range. In a series of extensive tests engineers of the American Felt Co., Glenville, Conn., have found that below a loading of 50 psi, it is an excellent material for isolating vibration and that as high as 80 per cent efficiency is obtainable under the proper conditions.

Small felt discs are recommended under each leg of a machine or at each corner of a flat bed rather than a felt sheet under the entire machine. For a flat bed, the felt area should be approximately 1/20th of the base area, but when supported by legs, the area of their base is suggested. Circular felt discs are said to be superior to square pads. Experiments demonstrated that a felt thickness of 1 to 1½ in. is most suitable for general applications.

When the machine has sidewise motion during operation, some method is necessary for anchoring the felt to the floor and machine. But in designing a flexible mounting for that purpose, it is important that bolts or any other anchoring devices be used in such a manner as to eliminate the possibility of transmitting vibration through them. Three mountings are proposed and their design is shown in the accompanying illustrations: (1) short studs may be used which protrude part way into the felt from top and bottom, or (2) the felt may be glued with suitable adhesives to both foundation and machine, or (3) retaining cups may be used which are mounted on the foundation and machine and which support the felt. The cups should be shallow enough to prevent any contact even with maximum loading.

Felt mountings designed by American Felt Co. engineers to stop sidewise motion when used under machines to isolate vibration.

Houghton Products for Defense Uses

A liquid salt bath for use in connection with the "hot nosing" of 155 mm. shells, ready mixed cutting oils for machining gun barrels and a process for blackening gun parts are recent developments of the E. F. Houghton Co., Philadelphia, Pa.

In heating for nosing by the salt-bath method, Liquid Heat N.D. is used in an immersed electrode furnace, being held at 1450 deg. Fahr. Shells are immersed half-way and held for seven minutes to bring the tip up to heat, then



moved to single-action presses, where Houghton's Hot Forging Agent, mixed with an inexpensive blending oil, is swabbed on the upper die for each nosing operation. Moderate sized shells, 75 to 105 mm., are sometimes nosed cold. For this cold-drawing operation, Houghton supplies a special variety of its Houghto-Draw series as a die lubricant.

For drilling gun barrels, Houghton's W. R. cutting oil No. 5 is available. For reaming and rifling operations L. C. refrigerant-base No. 10 is supplied, which is readily miscible with 100-viscosity paraffine oil in the user's plant. If the plant prefers a ready-

mixed oil, a special variety of Cut-Max, a light colored, non-staining oil of high film strength is supplied. This oil may also be used for chambering operations. For honing, Houghton offers its gun-barrel honing oil, which is claimed to give the necessary high finish and longer stone life.

Known as Houghto-Black, this single-bath process for blackening gun parts makes use of a salt solution which is held at its boiling point (290-295 deg. Fahr.) while the parts to be blackened are dipped in it. After a few minutes' immersion the parts are given a cold and a hot rinse. A lustrous, black finish, resisting oxidation, is said to result without any change in dimensions to the parts blackened.

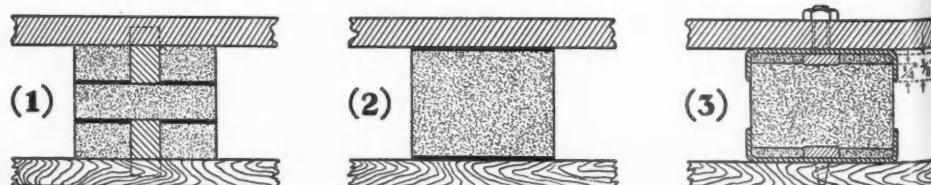
Formica Sparkless Wheel

In shell-loading factories, powder mills and other places where explosive and inflammable materials abound, it is necessary to take all possible precautions against accidents by eliminating the possibility of sparks being formed. It is known that rubber-tired wheels and wheels made of insulating material in service accumulate charges of static electricity, and therefore involve certain hazards. To eliminate these hazards in connection with industrial trucks used in such plants, Formica manufactures a special molded canvas wheel which differs from the standard, non-conducting molded canvas wheel in that colloidal graphite is introduced in the rim and hub material, thereby rendering it conducting. A connecting cable is molded into the wheel body and extends between the rim and hub sections, so that static charges generated in any part of the wheel can be readily carried off to ground. These wheels are being sold under the trade name "Staticon" by Divine Brothers Co., Utica, N. Y.

Johns-Manville STM-Type Clutch Facing

The J-M STM-type clutch facing is a recent development of the Johns-Manville research laboratories, New York. Although a molded facing, it is said to possess some of the desirable properties that are not usually associated with that type. The following claims are made for this new facing by the manufacturer.

It has high heat resistance and is able to withstand without serious effect



the high temperatures encountered in clutch work. It also has high friction stability and high resistance to wear. The manufacturing process is entirely new and was developed over a number of years.

Kerns Forging and Drawing Compounds

To increase the productivity of manufacturing plants engaged in defense work, the L. R. Kerns Co., Chicago, has developed hot-die compounds for use in forging projectiles. These compounds are said to not only speed production, but also increase die life. The same concern also has developed drawing compounds that ironed out difficulties encountered in drawing soft metals such as aluminum for airplane parts.

Aluminum Cutting Oils

Wayne Chemical Products Co., Detroit, has produced two new aluminum-cutting oils, the No. 2 and the No. 4. The No. 2 is a relatively light oil and is said to have exceptionally good lubricating value. It is used by several airplane manufacturers as well as by

plants making munitions and aluminum parts for machines, engines, guns, etc. The No. 4 aluminum-cutting oil is quite viscous and stays where it is needed for lubrication under the high pressures exerted in drawing and forming operations. We understand that this oil is being used by several large press plants drawing airplane body parts, wings, etc. It was developed some time ago in collaboration with one of this country's largest press plants. Both of the oils mentioned come in the "ready-to-use" form and are delivered in drums.

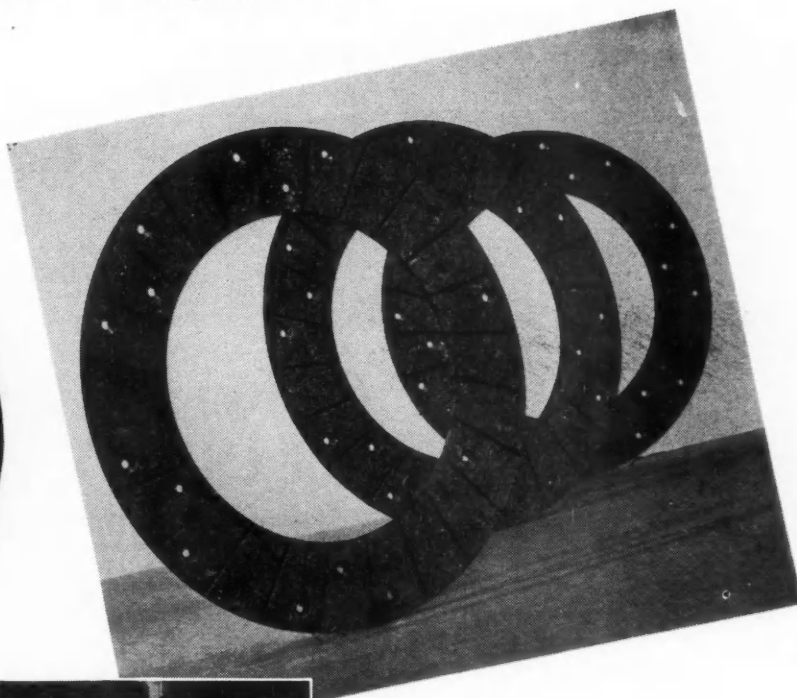
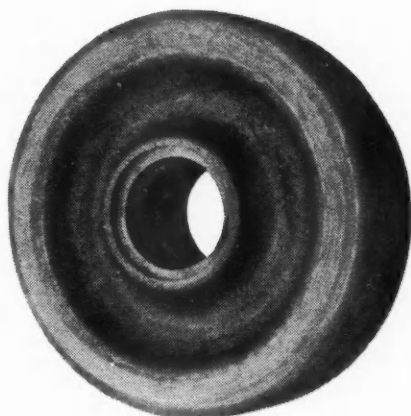
S. M. Ferrochrome

It is well known that chromium additions to cast iron increase its hardness, its resistance to wear, corrosion and heat, and improve its other mechanical properties. Unfortunately, chromium is a strategic material and must be conserved as much as possible. One

means to this end is to add the alloying element in such a way as to ensure a high recovery of chromium per unit of the element added to cast iron in the ladle.

Electro Metallurgical Co., New York, recently developed a new alloy for introducing chromium into cast iron, known as S.M. Ferrochrome. This alloy is claimed to permit a high percentage recovery, and also to greatly increase the depth of chill obtainable with a given chromium addition, which, of course, means that to obtain a given depth, of chill in the casting, less chromium is needed. It is further claimed that the use of this alloy permits the ladle addition of larger amounts of chromium per melt. As much as 4 per cent chromium has been added as S.M.

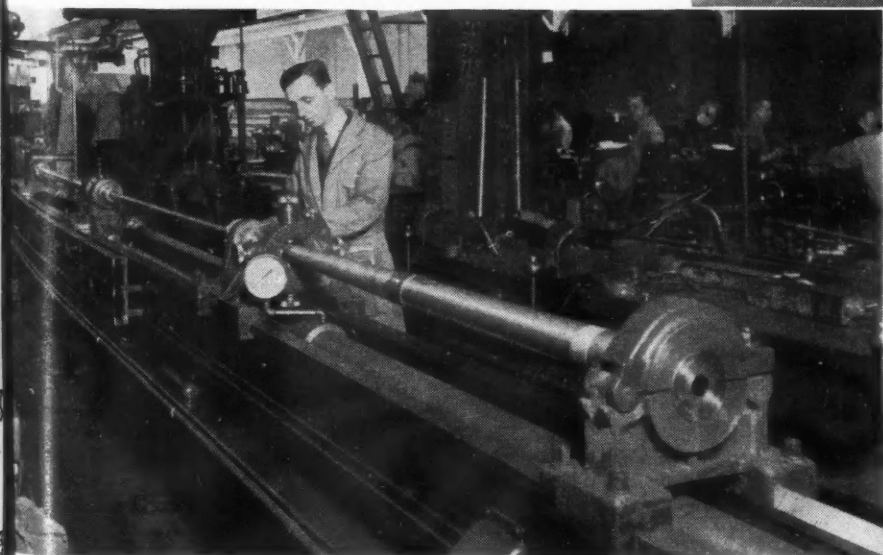
(Turn to page 175, please)



(Above) Clutch discs of J-M STM-type friction material.

(Upper left) Staticon sparkless molded canvas wheel for industrial trucks.

(Left) Houghton oils are being used to advantage in rifling operations on gun barrels. This LeBlond rifling machine was installed in a shoe machinery plant which has a gun barrel contract.



Curtailment Hanging Over Industry Like Dark Cloud

Smooth Flow of Materials Disrupted by Involved Priorities System, Officials State at Congressional Hearing in Detroit

Drastic curtailment of automobile production is unnecessary and threatens to create considerable unemployment, General Motors President C. E. Wilson declared in testifying at Detroit, September 24, before the Congressional committee investigating migratory labor problems. The four-man House committee is headed by Rep. John H. Tolan (Dem.), of California.

The General Motors executive pointed to the maladjustment of priorities and allocations by Washington officials as the real cause of the present crisis in the supply of metals and other essential materials. He said that the one flaw in the defense setup is the flow of materials and that the automobile industry learned years ago it was not necessary to order materials at once for an entire year's output, but rather to balance the flow of materials with production. A fear of shortage, he said, has resulted in an artificial shortage of materials. Inferentially, he blamed the Army and Navy for ordering and obtaining critical materials long before they were ready to use them.

Pointing out that a make-ready period of nine months or more often was necessary before defense production on certain items could begin, Wilson maintained that neither industry nor government could be blamed for the lag in getting such production under way. He stressed that no more than 15 per cent of automotive equipment could be diverted to defense production and that in many cases new plants were necessary for this specialized work. Consequently, automotive companies must have more defense orders if unemployment is not to occur in order to take up the slack created by the cut in automobile production.

Questioned on the subject of whether small business was being discriminated against, Wilson declared that small plants cannot make planes and tanks because they are not equipped to handle the work and only big business is qualified for such production. He said General Motors felt that it was not getting as much defense production as it should get considering that it has 8 per cent of the nation's productive capacity for durable goods.

"If the Government gave General Motors its proportional share of de-

fense orders, it would sound so big in dollars that people in Washington would be afraid of it," Wilson observed.

Bomber Output

He said the country will be disappointed in early winter about the number of bombers being turned out, but said that the automotive industry was not to blame. Rather it could be attributed to confusion on priorities and allocation of orders in Washington. Asked what would be done with the defense plants now being built after the emergency is over, Wilson said he was an optimist, and that he believed there would be enough accumulated demand for consumer goods to make use of them.

C. C. Carlton, Motor Wheel Corp.,
(Turn to page 164, please)

Quotas and Priority Ratings For Cars, Trucks and Parts

OPM Rulings Directed at Control of Materials for Vehicles and Their Repair; Interchangeable Parts on Ratio Basis

In conjunction with its undertaking to control the consumption of metals and other critical materials, the Office of Production Management in Washington has issued several orders affecting the production of passenger cars, trucks and replacement parts. Materials for them (except passenger cars and light trucks) have been given priority status and production quotas established by OPM.

Passenger Car Curtailment

Under General Limitation Order L-2, December production of passenger automobiles for civilian use is curtailed 48.4 per cent below the 1941 December output. Manufacturers will be allowed to produce 204,848 passenger cars that month compared to 396,823 during December last year. A passenger automobile is defined as a passenger vehicle, including station wagons and taxicabs, that has a seating capacity of not more than eight.

Taken together with a 26.5 per cent

Joint Project Undertaken to Simplify Steel Set-up

Reduction of steel specifications, compositions, sizes and shapes, particularly with respect to alloy steels as a means of increasing production from existing facilities, is contemplated in a program instituted by the OPM. At its request and under its supervision, the American Society for Testing Materials, the Society of Automotive Engineers and the American Iron and Steel Institute will carry out the project with the collaboration of the War and Navy departments. Directing the work will be an administrative committee selected from these five groups with advisers from other interested organizations. C. L. Warwick, OPM consultant and secretary-treasurer of the ASTM, is chairman of the committee.

The tabulation is to be designated as the National Emergency Steel Specifications, which in effect, it was stated, involves the selection of a minimum number from existing steel specifications, compositions and sections. OPM said it is its intention to have its Iron and Steel Section use the list as an aid for steel priorities and allocations.

curtailment ordered previously for August, September, October and November, this means an over-all curtailment of 32.2 per cent during the first five months of the model year that began August 1. Production for the five-month period will be 1,023,217 cars, compared with 1,510,167 during the same time last year.

The December curtailment will average 51.5 per cent for the larger companies—General Motors, Chrysler and Ford—while only 15.3 per cent for the other companies—Studebaker, Hudson, Nash, Packard, Willys-Overland, and Crosley. The small average percentage of reduction for the other companies is due to the fact that Crosley is being allowed to assemble a considerable number of cars for which parts have long been fabricated, and to the further fact that Hudson and Willys-Overland had unusually low production in December last year.

The passenger car allotments for De-
(Turn to page 156, please)



900 to the OUNCE!

HERE IS A MIDGET PIVOT that any automotive or aviation engineer could fondle with the delight of a jeweler examining a perfect stone under his glass.

It satisfies the engineer's definition of "precision" . . . doing the job of carrying the electrical contacts in a switch the size of a quarter! To qualify . . . it had to be a good insulator and strong enough to withstand at least 100,000 snaps of the switch without electrical or mechanical breakdown.

That's why a Durez plastic got the job.

In bumper blocks or 1/900 ounce pivots . . . plastics can fill the bill. From decoratively functional dashboards, steering-wheels and horn-buttons . . . plastics are steadily moving on into engine construction. Distributor housings and heads . . . spark-plug shields . . . water-pump impellers . . . switches are now molded of plastics. This year, a Dean of the industry an-

nounces that his new economy motor can use a *plastic* camshaft gear.

Beauty . . . durability . . . light weight . . . physical or dielectric strength . . . chemical inertness . . . precision . . . mass-production economies—all these are at your fingertips with plastics.

As you plan for the future . . . Durez chemists and engineers will be glad to make available to you their combined knowledge and experience of more than 20 years' work with plastics.

DUREZ PLASTICS & CHEMICALS, INC.

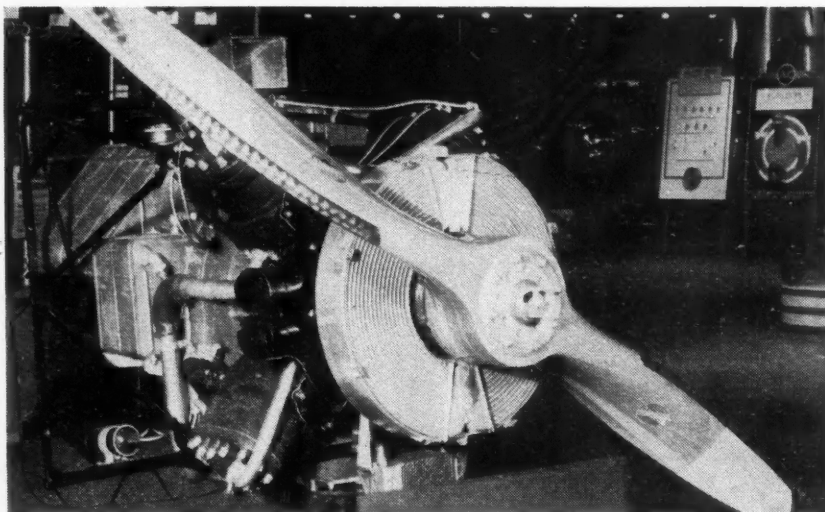
120 Walck Road, North Tonawanda, N. Y.

Durez Phenolic Resins are used for:

MOLDING COMPOUNDS	LAMINATING VARNISHES
INSULATING VARNISHES	INDUSTRIAL FINISHES
ADHESIVES	IMPREGNATING SOLUTIONS
PROTECTIVE COATINGS	

DUREZ PLASTICS & CHEMICALS, INC.

PLASTICS THAT FIT THE JOB



Engineered by Kettering

New U-type four-cylinder, liquid cooled engine for light planes has no valves, tappets or superfluous parts. Designed by Chas Kettering, it weighs 400 lbs.; turns up 200 hp. at 2500 r.p.m. Ceiling is 20,000 ft. A centrifugal blower scavenges the fuel; 72 octane gas is used.

Wage Rates Raised at Eight West Coast Aviation Plants

Southern California Companies Sign Agreements Adding Many Millions to Payrolls; Detroit Wage Scale Is Factor

Promoted by OPM to forestall work stoppages in the West Coast aviation industry, wage stabilization agreements have been signed by eight major Southern California aircraft companies. These agreements will tend to lessen the disparity between wage rates in West Coast airplane plants and Detroit aviation plants, where the higher scales of similar automotive work have prevailed. The agreements, retroactive to July 1 except for Douglas Aircraft Co., Inc., which goes back to July 3, contain a blanket 10-cent-an-hour raise for all workers not previously benefited in wage adjustments.

The beginners' wage is boosted from an average of 53 cents to 60 cents per hour, and thereafter workers will be given a monthly increase of five cents per hour for three months until a minimum working rate of 75 cents is reached. This compares with the previous rate of 59 cents and a minimum of 85 cents per hour in Detroit aircraft plants where automotive rates prevail. Double time for Sundays and holidays, a six-cent per hour bonus for night work and eight hours pay for six and one-half hours' work on the "graveyard shift" also are provided in the California agreements, which are for two years or the duration of the emergency.

Latest Detroit aircraft contract is that for a union shop and checkoff, signed by the Continental Motors Corp. with the UAW-CIO. Raises averaging 18 cents an hour and retroactive to Aug. 24 will make the average rate \$1.10 per hour. New employees must

join the union within 30 days. This is the third large automotive company to sign a closed shop contract, Ford's action last June being followed by Murray Corp. Murray's average aircraft wage is \$1.09 per hour. The union granted Continental the right to use the union label on its engines, most of which go into Army tanks or training planes.

West Coast companies signing the wage stabilization agreement were Lockheed and its affiliate Vega, Vultee, Northrup, Ryan, Solar, Douglas, and North American. Wage increases totaling \$25,000,000 annually for 44,000 workers at the Lockheed and Vega plants were negotiated by the International Association of Machinists (AFL). The Douglas boosts will add \$11,000,000 to payrolls for 32,000 employees. Workers at Vultee, Ryan, Solar and North American are affiliated with the UAW-CIO, whose aviation director, Richard Frankenstein, opposed any joint wage stabilization plan with AFL unions. The UAW-CIO has been engaged in an aircraft organizing drive.

Consolidated Aircraft Corp., of San Diego, which signed a two-year contract with the International Association of Machinists (AFL) June 12, was threatened with a strike by 23,000 workers who demanded a blanket 10-cent-an-hour increase. The company proposed to raise only the minimum rates for beginners from the 55-cent rate agreed upon in the June 12 contract. The dispute was referred to the National Defense Mediation Board.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE INDUSTRIES

General business activity remains relatively stable at or near peak levels. The seasonally adjusted index of *The New York Times* for the week ended Sept. 13 advanced to 130.2 per cent of the estimated normal from 129.3 for the preceding week, as compared with 110.6 a year ago. The index of *The Journal of Commerce*, without seasonal adjustment, for the same period rose to 128.0 per cent of the 1927-29 average, an all-time peak, from 118.9 for the week before, which included a holiday.

Department store sales during the second week of this month, according to the Federal Reserve compilation, were 8 per cent above the comparable total last year, as against a similar gain of 12 per cent for the preceding week and 17 per cent for the current year to date.

Contracts awarded for heavy construction during the week ended Sept. 18 declined to \$120,315,000 from \$139,478,000 a week earlier and were nearly the same as the sum a year ago, according to *Engineering News-Record*. The 1941 total to date, \$4,679,000,000, is approximately double the corresponding amount last year.

Railway freight loadings during the week ended Sept. 13 totaled 913,952 cars, the largest weekly number since 1930 and 13.6 per cent above the comparable figure last year.

Electric power production rose to an all-time peak in the same period and was 18.3 per cent greater than the output a year ago.

The number of business failures during the week ended Sept. 18 was 180, as compared with 169 in the preceding week and 216 a year ago, according to the Dun & Bradstreet report.

Crude oil production in the week ended Sept. 13 averaged 4,033,700 barrels daily, 218,750 barrels more than the average a week earlier and 73,700 barrels above the currently required output as computed by the Bureau of Mines.

Average daily production of bituminous coal for the same period was 1,833,000 tons, as against 1,920,000 tons in the preceding week and 1,517,000 tons a year ago.

The average daily rate of cotton mill activity declined contra-seasonally in the second week of September: *The New York Times* adjusted index was 169.4 per cent of the estimated normal, as compared with 173.3 for the week before and 121.2 a year ago.

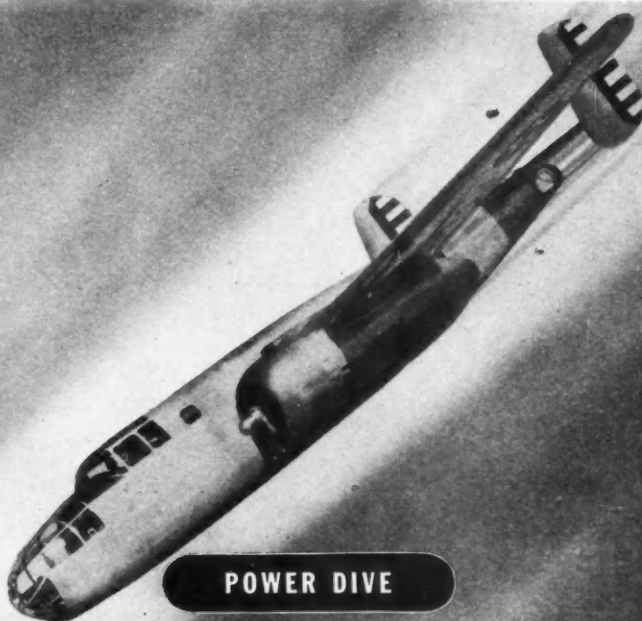
Professor Fisher's index of wholesale commodity prices for the week ended Sept. 19 rose one fractional point to 98.5 per cent of the 1926 average, as against 85.4 for the week ended Jan. 3, 1941.

Member bank reserve balances increased \$170 millions during the week ended Sept. 17, and estimated excess reserves rose \$140 millions to a total of \$5250 millions. Business loans of reporting members increased \$52 millions and stood \$1784 millions above the amount a year ago.

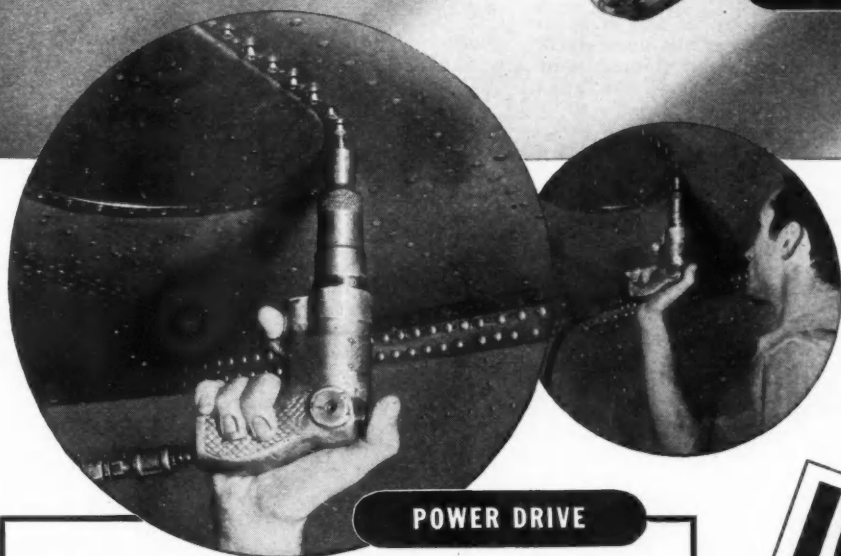
John A. Blum

John A. Blum, president of T. T. Hutchisson Co., Wheeling, W. Va., died at his home September 2 at the age of 80. He had been active with the company for 66 years.

Plane in a Hurry



POWER DIVE



POWER DRIVE

NORTH AMERICAN AVIATION, INC., SPEEDS PRODUCT DELIVERIES WITH PHILLIPS SCREWS

Straight and clean as the lines of the B-25 Bomber itself is the fast, safe power driving that speeds its assembly.

You, too, may save time and money—as much as 50%!—by eliminating "old-fashioned fastening" from your assembly line

PHILLIPS Screws cost less to use because they

- SAVE** time by permitting fast, safe power driving
- SAVE** workers' strength by easier driving
- SAVE** cost of lost-time accidents and refinishing
- SAVE** burred, split and wasted screws

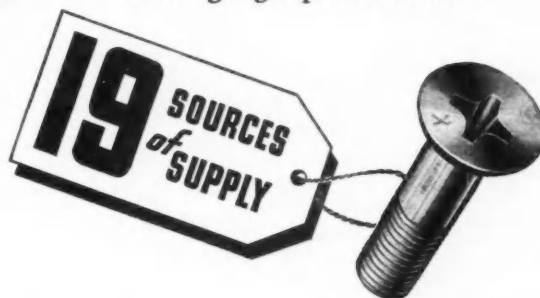
War or peace, the Phillips Screw gives you faster driving, stronger assemblies, lower costs. And Phillips Screw manufacturing capacity assures prompt deliveries. Write to any of the firms listed below.

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.

International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.

THE PHILLIPS RECESSED HEAD SCREW CLINGS TO THE TAPERED DRIVER—AND PREVENTS SLIPPAGE

It's easy to reach awkward positions *with one hand* when using Phillips Screws. And they set uniformly tighter, resisting high-speed vibration.



PHILLIPS RECESSED HEAD SCREWS

WOOD SCREWS • MACHINE SCREWS • SHEET METAL SCREWS • STOVE BOLTS
SPECIAL THREAD-CUTTING SCREWS • SCREWS WITH LOCK WASHERS

U. S. Patents on Product and Methods Nos. 2,046,343; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338.
Other Domestic and Foreign Patents Allowed and Pending.

Speed Product Deliveries by Cutting Assembly Time

Pheoff Manufacturing Co., Chicago, Ill.
Russell, Burdall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterbury, Conn.
Shakeproof Lock Washer Co., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.



Acme

Armor Plate Gets Tough

A new method of processing armor plate that is tougher and stronger than most armor plate, making it ideal for airplanes, has been developed. This photo, taken in the Breeze Corp. plant, shows flames shooting up from a plate in an oil bath. It's proof against .30 cal. guns.

Buick 1942 Prices

The following are the Buick 1942 delivered prices at factory and include standard equipment but are exclusive of transportation charges and state or local taxes:

SERIES 40A	
Utility Coupe	\$1,046
Conv. Coupe	1,324
Sedan, 4-d.	1,139
Bus. Sedanet	1,067
Family Sedanet	1,103
SERIES 40B	
Sedan, 4-d.	\$1,180
Bus. Sedanet	1,077
Family Sedanet	1,134
Estate Wagon	1,519
SERIES 40B-SE	
Sedan, 4-d.	\$1,262
Family Sedan	1,191
SUPER—SERIES 50	
Sedan, 4-d.	\$1,354
Conv. Coupe	1,529
Sedanet	1,303
CENTURY—SERIES 60	
Sedan, 4-d.	\$1,426
Sedanet	1,375
ROADMASTER—SERIES 70	
Sedan, 4-d.	\$1,559
Conv. Coupe	1,775
Sedanet	1,488
LIMITED—SERIES 90	
Tour. Sedan	\$2,564
Limousine	2,667
Sedan, 4-d.	2,359
Formal Sedan	2,513

Honor Automobile Men

Many notables of the automobile world are to be honored. The second annual meeting and luncheon of the Automobile Old Timers, Inc., to be held at the Hotel Roosevelt on October 15, will honor many automobile men. Citations are being awarded to Thomas A. Willard, Henry Cave, David C. Fenner, William K. Vanderbilt and Ray M. Owen, all of whom have distinguished careers in the development of the motor car.

Ford and GM Planning For Mass Tank Production

Plants Get Additional Defense Contracts; Defense Plant Corporation Awards Aimed to Increase Arms Production

Ford and GM will join Chrysler in the production of tanks in the near future. Ford's entry into the building of 28-ton medium tanks was revealed by OPM officials when they toured the Ford Rouge plant with C. E. Sorensen, vice-president in charge of production. Construction already is under way on a new steel casting foundry at the Rouge plant, which will make 1200 to 1300 tons of armor plate per month. Ford will do all the tank assembly work, possibly taking over part of the "B" building where a crane-way is available for the final assembly operations. This would necessitate moving the Mercury and tractor assembly lines to another part of the plant. Ford already is experimenting with an 8-cylinder V-type liquid cooled tank engine of 400 hp. similar to the company's experimental 12-cylinder aircraft engine.

GM's anticipated tank production was announced by Vice-President O. E. Hunt at the Corp.'s defense exhibit and 1942 model preview, when he stated that tanks in various sizes soon would be added to the company's long list of defense products. GM already is building 165 hp. two-cycle diesel engines to power the British Valentine Mark III, 16-ton tank at its Detroit Diesel Division. Cadillac engines have been mounted in light Australian tanks in the Near East. The Saginaw Steering Gear Division is making duel tank controls, while the Delco Appliance Divi-

sion at Rochester, N. Y., is turning out tank machine-gun mounts.

The new Ford steel foundry unit, which will require 5000 tons of shapes for construction, will comprise four Bessemer converters, four hot-blast cupolas and six electric furnaces. It will have a capacity of 300 tons of steel castings per day. These will include centrifugally cast center crankcase sections and cylinder barrels for Pratt & Whitney aircraft engines being made in the new Ford airplane engine plant and the armor plate for tanks. The 350,000 sq. ft. foundry will be adjacent to the open hearth building at the Rouge and is expected to begin production in January.

Ford also has a liquid-cooled pancake airplane engine in the process of development. It is designed for mounting in plane wings to reduce wind resistance. This is an 8-cylinder engine with two crankshafts geared together to drive a propeller. The combustion chambers face inward, with the crankshaft at the outside.

Ford recently was granted a Defense Plant Corp. allocation of \$9,788,916 for the 400-ft. extension at the rear of the aircraft engine plant now under construction. This added approximately 288,000 sq.ft. of floor area and will up production capacity to 40 2000-hp Pratt & Whitney engines daily. Orders now total 10,517 engines.

Participation of the automotive in-
(Turn to page 160, please)

CALENDAR

Conventions and Meetings

Boston Conference on Distribution, Boston, Mass.	Oct. 6-7
Natl. Safety Council, Chicago.....	Oct. 6-10
Exposition of Power & Mechanical Engineering, Chicago	Oct. 6-11
Amer. Society of Tool Engineers, Toronto, Canada	Oct. 16-18
National Metal Congress and Exposi- tion: Cooperating societies—Ameri- can Society for Metals, Wire Asso- ciation, American Welding Society, Institute of Metals and Iron and Steel Divisions of American Insti- tute of Mining and Metallurgical Engineers, Philadelphia	Oct. 20-24
SAE Natl. Fuels & Lubricants Mtg., Tulsa, Okla.	Oct. 23-24
Society of Automotive Engineers, Air- craft Production Meeting, Los Angeles	Oct. 30-Nov. 1
SAE West Coast Transportation Mtg., San Francisco	Nov. 5-6
SAE Natl. Transportation & Mainte- nance Mtg., Cleveland.....	Nov. 13-14
National Assoc. of Manufacturers, New York City	Dec. 3-5
Natl. Automobile Dealers Assoc., Chi- cago	Jan. 20-21

Buy Forging Equipment *On the Basis of Mechanical Soundness*

Buyers of forging equipment should insist upon mechanical soundness as the prerequisite rather than accept equipment because it is available immediately.

Ajax is prepared to produce units of forging equipment on an increased schedule which protects users from having to accept equipment merely on the basis of availability. Ajax has improved and expanded its manufacturing facilities. Machine tool requirements have been anticipated so that all machining still can be performed within its own plant, even on greatly increased outputs and established standards of accuracy maintained. Heavy casting requirements are anticipated so that these come from the foundry to the Ajax plant in steady flow.

The mechanical ability of every employee is utilized to the utmost, and the training of younger men for the exacting machine work required in the construction of Ajax Forging Machines has been and is being followed as an established policy.

In all this there is not the slightest compromise on the mechanical soundness that assures productive capacity, accuracy and dependability of Ajax Forging Machinery on high speed production. There is at present no occasion to forego the increases in production that are available through the use of Ajax Forging Equipment, and users who will accept nothing less can obtain reasonable deliveries of Ajax Forging Machines with their established mechanical soundness.

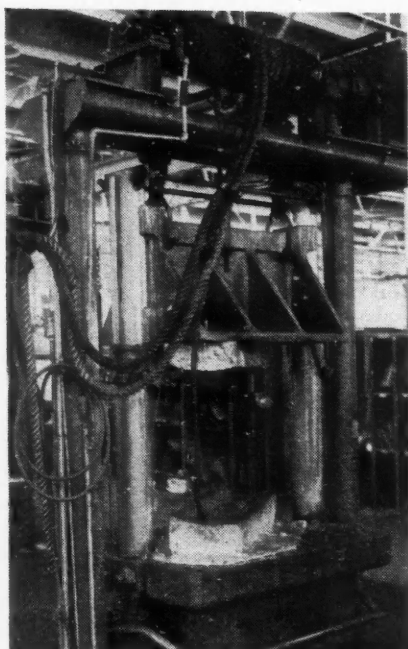


THE **AJAX**

MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND, OHIO

621 MARQUETTE BUILDING • CHICAGO, ILLINOIS



Ryan Drop Hammer

This specially designed drop hammer was developed by the Ryan Aeronautical Co., for use in its plant to fabricate aluminum and stainless steel.

Machine Tool Shipments Up

Machine tool shipments in August totaling \$64,300,000 were the highest on record in the history of the industry, according to the National Machine Tool Builders' Assoc. This is an increase of \$6,200,000 over July and \$23,500,000 over August a year ago.

No Chicago Auto Show

Following a recent meeting of the board of directors of the Chicago Automobile Trade Association, it was announced that the forty-second annual Chicago automobile show, originally scheduled for October 12-19, will not be held.

New Truck Registrations

	NEW REGISTRATIONS			SEVEN MONTHS		Per Cent Change, 7 Months 1941 over 1940	Per Cent of Total Seven Months	
	July	June	July				1941	1940
	1941	1941	1940	1941	1940			
Chevrolet	22,893	21,722	15,805	142,076	112,526	+ 26.2	33.71	33.58
Ford	18,122	17,325	14,296	120,516	95,224	+ 26.6	29.60	28.43
International	9,531	8,580	7,012	59,204	44,351	+ 33.7	14.05	13.24
Dodge	6,629	5,951	4,691	38,621	34,202	+ 13.0	9.16	10.21
G. M. C.	4,543	3,800	3,261	27,290	22,549	+ 21.2	6.47	6.73
Plymouth	863	904	999	6,510	6,469	+ 0.8	1.54	1.93
Mack	1,055	851	718	5,741	4,218	+ 36.1	1.36	1.26
White	1,047	835	469	5,733	3,721	+ 54.0	1.36	1.11
Diamond T.	595	507	642	3,830	3,772	+ 38.2	.91	1.13
Studebaker	526	456	77	2,736	765	+257.0	.65	.23
Autocar	262	237	160	1,520	965	+ 57.6	.36	.29
Divco	264	228	106	1,438	1,004	+ 43.8	.34	.30
Brockway	250	179	153	1,360	851	+ 59.8	.32	.25
Willys-American	226	214	249	1,210	1,471	+ 17.8	.29	.44
Federal	158	114	121	933	966	- 3.5	.22	.29
Reo	150	135	78	903	132	+585.0	.21	.04
Hudson	71	86	64	548	506	+ 8.1	.13	.15
Sterling	54	32	28	279	195	+ 43.0	.07	.06
F. W. D.	28	12	17	149	155	- 3.8	.04	.05
Bantam	7	2	26	38	284	- 86.5	.01	.08
Miscellaneous	133	95	82	822	671	+ 22.5	.20	.20
Total	67,412	62,265	49,053	421,457	334,997	+ 25.8	100.00	100.00

Lining Life Longer with Extra Smooth Brake Drum Industry Asked To Find Jobs for Ex-Soldiers

Five different brake linings tested on a small inertia machine by Bureau of Standards experts indicate that brake drums, with a roughness of not more than 15 micro in., add appreciably to the life of brake linings. Results of the tests, described by Rolla H. Taylor and William L. Holt, bureau experts, showed:

1. In general, woven lining are more affected by roughness of the drums than are molded linings.
2. The rougher the drum at the start, the greater the wear. In some cases the wear of a particular lining tested against commercially-turned drums was approximately four times as great as when tested against drums which had been given a very smooth finish.
3. In making wear tests of linings, brake drums of uniform and equal roughness should be used. Very smooth drums are greatly to be desired because they give more consistent results and less time is required to obtain reliable data.

Hugh A. Scallen

Victim of a sudden heart attack, Hugh A. Scallen, 46, was stricken September 2 while driving his car. He was district manager of the New England branch of the Jessop Steel Co.

Announcing that the Selective Service System will give the same assistance in finding jobs for men completing their terms of service in the regular Army, Navy or Marine Corps, as it does to its own selectees and members of the National Guard, Brig. Gen. Lewis B. Hershey, Director of Selective Service, urges the patriotic cooperation of all employers to see that returning soldiers are given prompt employment.

Employers can best aid to reestablish returning soldiers in civil life, General Hershey said, by working with the Reemployment Committeemen of their Local Selective Service Boards and with their State Employment Offices. He suggested that they immediately advise these agencies of all available jobs.

Soldiers returning to civil life will each receive a form on which he should state his civilian experience and other data that will be helpful in finding him a suitable job. These forms will be placed in the hands of the Local Board Reemployment Committeeman before the soldier is discharged.

July New Passenger Car Registrations and Estimated Dollar Volume by Retail Price Classes*

PRICE CLASS	NEW REGISTRATIONS								ESTIMATED DOLLAR VOLUME							
	JULY				SEVEN MONTHS				JULY				SEVEN MONTHS			
	Units		Per Cent of Total		Units		Per Cent of Total		Dollar Volume		Per Cent of Total		Dollar Volume		Per Cent of Total	
	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940
Chevrolet, Ford and Plymouth	206,353	173,847	52.70	55.22	1,494,047	1,167,794	52.28	54.88	\$169,800,000	\$132,900,000	46.51	48.91	\$1,229,322,000	\$892,800,000	47.90	48.56
Others under \$1,000	71,717	98,235	18.31	31.20	532,204	676,734	18.62	31.80	66,900,000	88,900,000	18.32	32.72	402,708,000	612,300,000	15.69	33.30
\$1,001 to \$1,500	105,914	40,849	27.05	12.96	779,473	268,768	27.28	12.63	115,900,000	46,200,000	31.74	17.00	846,152,000	304,000,000	32.97	16.53
\$1,501 to \$2,000	6,855	1,198	1.75	.39	43,869	9,174	1.54	.43	10,700,000	2,100,000	2.93	.77	68,788,000	16,000,000	2.68	.87
\$2,001 to \$3,000	744	690	.19	.23	8,002	5,408	.28	.26	1,800,000	1,600,000	.50	.59	19,274,000	13,100,000	.76	.72
\$3,001 and Over		3				69				15,000		.01		355,000		.02
Total	391,583	314,822	100.00	100.00	2,857,595	2,127,947	100.00	100.00	\$365,100,000	\$271,715,000	100.00	100.00	\$2,566,244,000	\$1,836,555,000	100.00	100.00
Miscellaneous	212	424			1,581	2,113										
Total	391,795	315,246			2,859,176	2,130,060										

* All calculations are based on delivered price at factory of the five-passenger, four-door sedan, in conjunction with actual new registrations of each model. The total dollar volumes are then consolidated by price classes.

ARE YOU SELLING OIL LEAKS?



Now more than ever oil should not be wasted. Not only are oil leaks uneconomic, but they are damaging to customer-satisfaction. Inasmuch as oil leaks are unnecessary there is no excuse for unsightly stains on floors and roads. It is false economy to use inferior sealing materials. We say . . . in all sincerity . . . buy *good* felt. Buy it from us or from some other company . . . but buy *good* felt and save oil, forestall complaints and *insure* customer-satisfaction. Our modern Cutting Shops at Port Chester, N. Y. and Detroit, Mich., have the men and the machinery to give you the Felt Seals you need, speedily, economically and precisely. We are always glad to be of help to engineers, chemists, specification men and purchasing agents. Factual Data Sheets are available to help in setting up your blueprints, or you may prefer to have an American Felt representative call.

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General Offices: GLENVILLE, CONN.

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PRODUCERS OF FINEST QUALITY PARTS FOR OIL RETAINERS, GREASE RETAINERS, WICKS, DUST EXCLUDERS, GASKETS, INSULATING FELTS, CHANNEL FELTS, UPHOLSTERY RISER STRIPS, BODY SILENCING PARTS, DOOR MECHANISM GASKETS, AND BODY POLISHING WHEELS

October 1, 1941

When writing to advertisers please mention *Automotive Industries*

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Quotas and Priorities

(Continued from page 148)

cember were determined and distributed among the parent companies on the basis of their production during the last three model years. The allotments for December and for the five-month period (August-December) are given in the accompanying table.

Passenger Car and Light Truck Replacement Parts

Production of replacement parts for passenger cars (seating capacity of 15 or less) and light trucks (less than 1½ tons rated load capacity) is covered by two orders. One is Limitation Order L-4, which sets a top quota for the production of repair parts for passenger cars and light trucks, and the other is Preference Rating Order P-57, which extends priority assistance in securing the material needed to manufacture the authorized amounts. No preference ratings have been assigned to materials for the manufacture of passenger cars and light trucks.

L-4 order provides that a producer of repair parts for passenger cars and light trucks may make during the period from September 15 to Dec. 31, 1941, 60 per cent of the number of parts sold by him for replacement purposes during the period from January 1 to June 30, 1941. This means that during the last 14 weeks of this year, he will be operating at the same high rate as during the first six months of 1941, when production already had jumped to approximately 130 per cent of the 1940 output.

In determining the number of replacement parts which he may produce between September 15 and the end of the year, he may exclude from his calculations all parts sold during the first six months of the year to the U. S. Army and Navy, certain other listed government agencies, and to the governments of those countries whose defense the President deems essential to the defense of this country. He may likewise manufacture, after September 15, to fill orders from these sources without regard for his established quota for civilian uses.

P-57 order assigns an A-10 rating to deliveries of materials for the manufacture of the listed replacement parts within the quantities established in the limitation order. A manufacturer of replacement parts is not required to make application to the Priorities Division before applying the A-10 rating to his orders. This may be done by certification on his purchase order that the rating is being applied under the terms of order P-57. A supplier may follow the same procedure, if it is necessary to assign the rating to deliveries to him by a sub-supplier.

Replacement parts are defined as the following functional parts (including their components) for making repairs: engine, clutch, transmission, propeller shaft, axles, brakes, wheels, hubs,

drums, starting apparatus, spring suspension, brackets and shackles; also the exhaust, cooling, fuel and electrical systems, including generators, lights, reflectors and batteries; also gages, speedometers, motors, fuses, flares, directional signals, rear-view mirrors, windshield wipers, control mechanisms, steering apparatus, driving gears. Replacement parts do not include parts entering into the production or assembly of new light motor trucks or passenger automobiles.

Light Truck Quota

Limitation Order L-3 provides that production of light trucks for non-military purposes are to be curtailed 9 per cent during the four-month period of August, September, October and November. This means that approximately 87,000 light trucks may be produced for civilian use during the four months, compared with about 96,000 during the same period last year. Exact quotas by companies are being worked out.

If OPM allows this light truck production rate to continue for the full model year, a question to be decided subsequently on the basis of the material situation then prevailing, the yearly production for civilian purposes will amount to 261,000 as compared with 370,000 in the last model year, or a reduction of 30 per cent.

Heavy and Medium Trucks

Total production of light, medium and heavy trucks during the current model year is expected to be substantially in excess of last year's due to vital transportation and military needs. Much of the facilities released by the light truck curtailment may be shifted to production of light military vehicles.

Manufacturers of heavy motor trucks (rated capacity of 3 tons or over), medium motor trucks (1½ tons or over), truck trailers (5 tons or over), public passenger carriers (not less than 15 seats) and essential replacement parts for these vehicles have been granted a preference rating of A-3 (Limited Preference Rating Order P-54) to help them obtain materials.

In Limitation Order L-1a, no restriction is placed in any way on the production of heavy trucks, which are carrying most of the defense truck transportation load. However, it states that during the period September 1 to November 30, a producer may not manufacture more than one-half the number of medium motor trucks, truck trailers and passenger carriers produced during the first half of the year, except that all trucks ordered for specific defense purposes, as defined in the order, may be produced without limit. This means, in effect, that the producers of these trucks and carriers may produce all trucks needed for defense during this three-month period and may continue producing civilian trucks at the going rate during the first half year. Replacement parts for these trucks and carriers are limited as follows: a producer shall not manufacture for replacement purposes more than 60 per cent of the number of parts sold for replacement purposes during the first half year. This, in effect, permits increased production of replacement parts during the three-month period.

Interchangeable Parts

In cases where a manufacturer is unable to ascertain whether a replacement part is intended for use in vehicles in the A-3 or in the A-10 (Turn to page 158, please)

PASSENGER CAR ALLOTMENTS (Non-Military Use)

	Allotments December, 1941	Percentage Decrease of Allotments Below December, 1940 Production	Allotment First 5 Months 1942 Model Year	Percentage Decrease of Allotments Below First 5 Months Production of 1941 Model Year
GENERAL MOTORS CORP.				
Chevrolet.....	45,180	51.2%	225,689	30.8%
Buick.....	18,402	51.1	81,927	40.9
Pontiac.....	14,358	48.0	71,706	38.2
Oldsmobile.....	11,753	50.9	58,717	38.3
Cadillac.....	2,874	55.3	14,343	29.0
Total General Motors Corp.....	90,547	50.8%	452,382	35.0%
CHRYSLER CORP.				
Plymouth.....	25,184	48.8%	125,796	41.5%
Dodge.....	11,863	52.1	59,257	25.0
Chrysler.....	6,028	61.1	30,109	35.8
De Soto.....	4,196	56.8	20,958	36.9
Total Chrysler Corp.....	42,271	52.3%	236,120	36.9%
FORD MOTOR CO.				
Ford.....	32,307	50.9%	161,370	27.2%
Mercury.....	4,426	58.9	22,108	29.7
Lincoln-Zephyr.....	1,276	52.5	6,376	33.1
Total Ford Motor Co.....	38,009	52.1%	189,854	27.7%
Total General Motors, Chrysler and Ford.....	175,847	51.5%	878,356	34.1%
OTHER MOTOR COMPANIES				
Studebaker.....	8,834	18.4%	44,123	22.6%
Hudson.....	6,476	+25.8	32,350	31.3
Nash.....	5,500	45.0	27,472	11.2
Packard.....	5,771	22.0	28,827	12.9
Willys-Overland.....	1,944	+137.4	9,712	+5.8
Crosley.....	476	+1260.0	2,377	+980.4
Total Other Companies.....	29,001	15.3%	144,861	18.4%
Grand Total.....	204,848	48.4%	1,023,217	32.2%

PRECISION PRODUCTION

... — *vital to* VICTORY

The swift and gigantic steps that American industry is taking in the program for national security are largely due to the *precision production* of metal parts. When the present emergency is ended, the record will show that one of the outstanding accomplishments was the production of defense material, not only in stupendous quantities but with each vital metal part repeatedly held to an extremely high standard of accuracy in size and finish. Today, in the midst of this emergency, Ex-Cell-O standard machine tools are performing numerous precision jobs in practically every industry engaged in defense work. They are taking an important part in making possible the speed and accuracy upon which success depends.

Illustrated here is an aircraft part being bored on Ex-Cell-O Precision Boring Machine (Style 112-C) with Ex-Cell-O Universal Fixture. Standard Ex-Cell-O Boring Machines are used extensively in production because of their ability to hold extreme accuracy in size and finish.

Picture below shows one of many precision parts being produced for airplanes on Ex-Cell-O Standard Thread Grinding Machines (Style 31 is shown here). Precision thread grinding is now universally employed in the production of all vital threaded parts used in aircraft.

EX-CELL-O
CORPORATION

DETROIT
MICH.



The plane illustrated to the left is the Curtiss P-40, a single seat low wing pursuit plane, many of which are being produced daily by the Curtiss-Wright Corporation. Ex-Cell-O precision machines, producing close-limit aircraft parts for this plane, are shown above.



Precision THREAD GRINDING, BORING AND LAPPING MACHINES,
TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES,
BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS

Hermann A. Brunn

Hermann A. Brunn, 67, creator of custom-built automobiles, died suddenly September 21 in his Buffalo home.

As president of Brunn & Co., manufacturers of auto bodies, he built a ceremonial car for Riza Khan Pahlevi, recently deposed shah of Iran. Other notables for whom he built cars included Katharine Cornell, J. P. Morgan, Kirsten Flagstad and Katharine Hepburn. He created an entirely new line of Lincoln cars for the Henry M. Leland interests. When the Ford Motor Co. took over the Lincoln company, Mr. Brunn continued as an advisor.

Japan Car Output Drops 33 Per Cent

Shortages of materials, particularly iron and steel, will decrease Japan's production of automotive vehicles one-third below the 1940 rate. This report, made public by the U. S. Department of Commerce, said that financial problems and lack of skilled laborers also are hampering the industry.

The output of passenger cars in Japan this year has been restricted to "special vehicles" for the Army and possibly a few units for export.

Quotas and Priorities

(Continued from page 156)

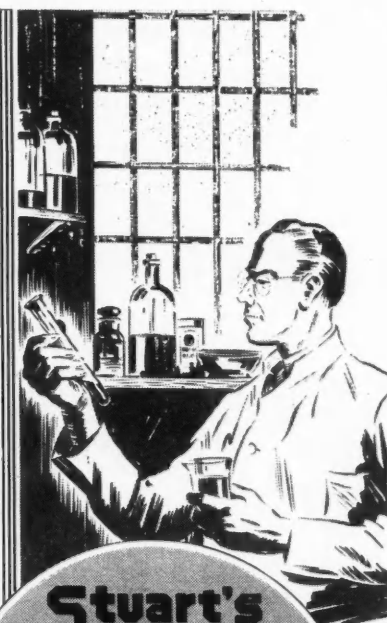
category as defined by the Priorities Division, the OPM Division of Civilian Supply has requested that the materials for such interchangeable parts be estimated on the basis of 20 per cent for A-3 rated parts and 80 per cent for A-10 rated parts. If more than 20 per cent of the interchangeable parts falls in the A-3 category, to increase the percentage the manufacturer should obtain permission from the automotive branch of the Civilian Supply Division. Otherwise, for replacement parts that are to be used exclusively in either the A-3 or A-10 classifications, materials are to be ordered without regard to the foregoing ratio.

The 20-80 formula, manufacturers are told, was based on an estimate that approximately 15 per cent of the total annual mileage is accounted for by vehicles other than passenger cars and light trucks. In order to make allowance for factors other than mileage, a 5 per cent margin was added to this 15 per cent figure, thus arriving at a 20 per cent proportion of replacements parts for heavy and medium trucks and 80 per cent for passenger cars and light trucks.

The FIRST CUTTING COMPOUND

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CARBIDE and other VERY HIGH SPEED CUTTING TOOLS



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SOLVOL
AQUAMIX
Liquid Cutting Compound

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THE rapidly increasing use of carbide and other high speed tools emphasizes the immediate importance of this original type of cutting fluid. STUART'S SOLVOL Liquid Cutting Compound was developed especially for this exact condition. Where operations run "too hot" for properly applied straight cutting oils — and where ordinary soluble cutting oils or soluble paste compounds fail to produce satisfactory finish or tool life — that's the place for this original **Stuart Oil** development.

WIRE TODAY for working sample — **FREE** to any industrial concern working on defense orders. To assure proper application please tell us name of part, stock, machine and cutting operations.

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PUBLICATIONS

The Industrial Oils Division of Smith Oil & Refining Co. has issued a new folder describing its warm-dipping grade of **Slushol**. A steel test strip showing an actual sample of the new Slushol "C" is attached to the back of the folder.*

A booklet, **Electrode Consumption Calculator**, for estimating the cost of arc welding electrodes, has been published by Air Reduction.*

Walker-Turner Co., Inc., has announced a new, illustrated catalog, describing in detail its standard line of **metal working and wood working machine tools**.*

A new folder by Jessop Steel Co. describes its **magic chisel steel**, a silicon-molybdenum bearing cold work steel for use where extreme toughness and resistance to fatigue are essential requirements.*

Checking Internal Spur and Helical Gears is the title of a new circular by The Fellows Gear Shaper Co., illustrating and describing the checking of internal gears on its involute measuring machine.*

Catalog No. 142, Brown & Sharpe Mfg. Co., lists its **complete line of machine tools and equipment**, machinists' tools, cutters, magnetic chucks, etc.*

Blades for inserted tooth milling cutters and all-purpose type lathe tools with full width tips, made of **Tantung "G"**, are listed in two new bulletins by Vascology-Ramet Corp.*

A folder illustrating and describing the new **Landis No. 6 Precision Thread Grinder** has been issued by Landis Machine Co.*

The B. F. Goodrich Co. has just published an 8-page catalog section on its **Ameripol D synthetic rubber**, which is used in making mechanical rubber products.*

Two new bulletins describing the use of Ampco Metal are **Ampco Metal in Gears** and **Ampco Metal in Heavy Machinery**, published by Ampco Metal, Inc.*

*Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

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So we pull together, as a team, even while we are competing. That's healthy, constructive co-operation.

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mation. We believe in pooling brain power and experience and research results. We believe that both our business and yours will benefit—through improved products, and often, by reduced cost of manufacture.

The reports of these regular discussions are circulated among our members—that all may profit by them. The result is that your local foundryman has behind him an alert and thinking Industry.

When you are looking for new materials, new designs or new money-saving methods, consider Steel Castings—the most economical form of getting all of the adaptable properties of steel.

Your own foundryman will be glad to consult with you—to give you the accumulated experience of his Industry. Or you may, without obligation, write to Steel Founders' Society, 920 Midland Bldg., Cleveland.

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| 1 <i>Uniform Structure</i> for strength and shock resistance. | ishing costs, better appearance. |
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MODERNIZE AND IMPROVE YOUR PRODUCT WITH

STEEL CASTINGS

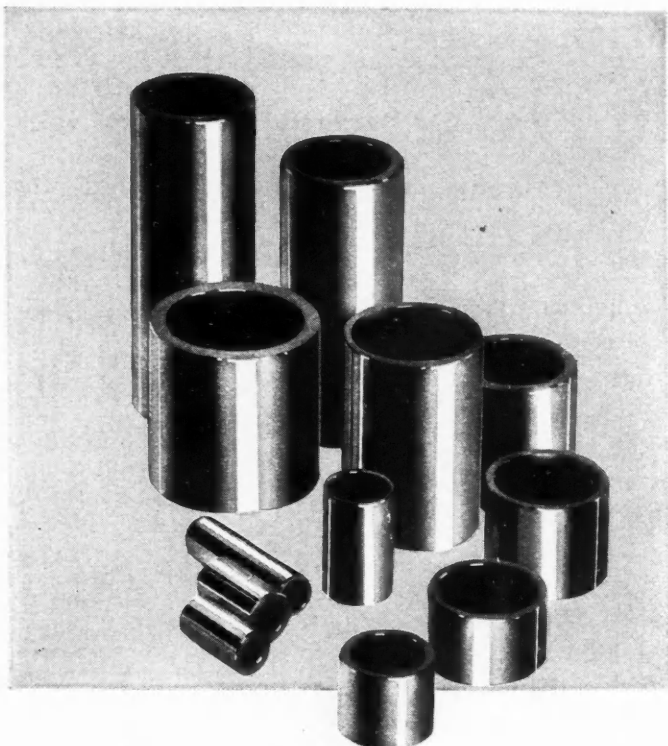
Ford & GM Tanks

(Continued from page 152)

dustry in the Maritime Commission's program for speeding the construction of cargo ships, has been revealed by the Navy Department's announcement of a newly designed 1900-ton shallow-draft freighter powered by automotive engines. The ship, called the "Sea Otter," will be 270 ft. long. An 80-ft. working model was built by the Livingston Shipbuilding Co., Orange, Tex. Ships, Inc., has been financed by the RFC to build these vessels in mass production.

Other features of the ship will be a

10-ft. draft, 40-ft. beam, flat deck and a 1500-ton cargo capacity. Anti-aircraft guns will be mounted on the bridge or "turret" for protection. Automobile manufacturers will turn out steel for the hull, in addition to making the power plants. The ship will be driven by 16 6-cylinder Chrysler automobile engines mounted in groups of four attached to four propellers amidship. Engines will develop 1700 hp. An interesting feature will be the use of automobile tires to serve as drive-shaft bearings. The shaft will pass through the tires, which will be inflated to hold the shaft steady and absorb the throb of the propellers.



... It will pay you to STANDARDIZE

• If you are having trouble securing your needs in plain bronze bearings . . . perhaps we can help you. Compare your required sizes with our list of stock items. The chances are ten-to-one that, from our list of over 850 sizes, we can fill your order . . . right off the shelf.

• Johnson GENERAL PURPOSE Bronze Bearings are cast in S.A.E. 64—the favorite alloy of engineers and maintenance men everywhere. Each bearing is machine finished to standard tolerances and ready for immediate assembly. Complete stocks are carried in all of our 22 warehouses. Write for a copy of our latest catalogue and see for yourself how it will pay you to STANDARDIZE on Johnson General Purpose Bearings.



JOHNSON-BRONZE

Sleeve BEARING HEADQUARTERS

625 S. MILL STREET • NEW CASTLE, PA.

A six-fold increase in its original order for Oerlikon 20-m.m. rapid-firing anti-aircraft guns, now estimated in excess of \$70,000,000, has compelled the Pontiac Motor Division of GM to build a 305,000-sq.ft. addition to its gun manufacturing facilities at Pontiac, Mich. The new plant, a 640 x 480-ft. one-story building of the semi-blackout type, will be completed early in January. Final assembly of the guns will take place in the new plant, the old plant being used for the manufacture of 20 intricate parts of the gun barrel and breech mechanism. The other 175 parts are supplied by more than 40 subcontractors.

A new underground 110-yard range for testing the guns will be completed in mid-November. The Oerlikon fires more than 500 explosive shells per minute and has a range of more than 1500 yards. It is designed chiefly as a protection for naval vessels and merchant ships against dive bombers. Pontiac delivered the first gun in August.

Recent Defense Plant Corp. awards have been \$567,000 to Hyatt Roller Bearing Division of GM, Harrison, N. J., for machinery to manufacture aircraft engine bearings; \$505,301 to A. O. Smith Corp., Milwaukee, for plant expansion to make aircraft landing and tail gear assemblies; \$900,000 to Graham-Paige Motors Corp. for manufacture of aircraft engine parts; \$173,950 to Saginaw Wilcox-Rich Division of Eaton Mfg. Co. for machinery for aircraft valves; and \$116,583 to Battle Creek Wilcox-Rich plant for facilities to make aircraft engine parts; \$8,848,542 to Briggs Mfg. Co. for a new plant to make airplane equipment. Details are lacking, but it had been announced earlier that Briggs is tooling up for a 200 per cent increase in manufacturing airplane parts for Boeing B-17E bombers, a 100 per cent increase in wing assemblies for Vought-Sikorsky, parts for Douglas attack bombers and fuselage parts for Martin B-26 bombers.

New national defense contracts include \$4,016,562 to Yellow Truck & Coach Mfg. Co. for 2½-ton trucks; \$2,809,561 to Chrysler Corp. for Dodge ½-ton trucks; \$522,901 to Sparks-Wilmington Co. for aircraft mooring kits and signal assemblies; \$108,460 to Fruehauf Trailer Co. for semi-trailers; \$197,673 to Ainsworth Mfg. Corp. for bomb shackle assemblies; \$553,383 to Highway Trailer Co. for 2-wheel semi-trailers; and \$160,320 to Chevrolet for sedans.

New \$2 Million Magneto Plant

Plans for a new \$2 million plant to provide additional production capacity for aviation magnetos are announced by American Bosch Corp., Springfield, Mass.

Lava Expands Plant

The new plant of the American Lava Corp., Chattanooga, Tenn., will increase the company's manufacturing capacity by 300 per cent.



Tanks enough for an Armored Division..

FROM STEEL SAVED
EVERY MONTH BY **RODINE**

Lumbering monsters . . . Mediums mounting 75's, Light Tanks bristling with machine guns—

And Rodine, in the world's pickling baths last year, saved steel enough monthly to equip a whole armored division!

Conservation of steel is the fastest, first step to increased production. Rodine saves the steel normally lost by acid attack in pickling. This internationally accepted Selective Control Chemical lowers consumption of acid, cuts down time and labor required to charge vats, reduces acid brittleness, blistering, corrosion, eliminates formation and escape of poisonous acid mist.

American Chemical Paint Company, with more than 20 years' experience in the development of chemicals for saving and protecting steel, offers you the experience of their research and manufacturing facilities to conserve steel. Adequate stocks are available to meet your demands. Write for Bulletin No. 13.

AND THIS EFFICIENT ACID CLEANER DEOXIDINE, another ACP product, removes oil, eradicates rust, neutralizes rust producers and creates an etched, passive surface that holds paint perfectly.



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Greyhound Orders 366 Buses

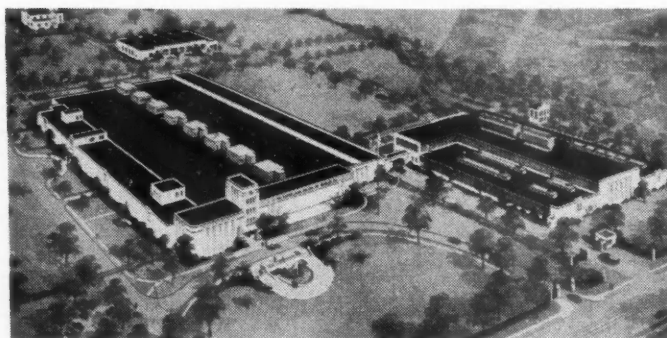
The Greyhound Corp., Chicago, nation-wide motor coach transportation system, has announced placing orders for 366 new all-steel buses valued at \$5,350,000. The order is divided among Yellow Truck & Coach, 283; American Car & Foundry, 48; General American Aerocoach, 35.

Harry H. Knepper

Harry H. Knepper, pioneer automotive parts maker, died recently after a two-weeks illness, at the age of 63. margin its cost of labor and materials.

New Cleveland Plant

This modern plant is under construction for the Cleveland Graphite Bronze Co. The new windowless factory will occupy 275,000 sq. ft. and permit centralization of the company's production of bearings for automotive and aircraft industries.



Studebaker 1942 Prices

Following is detailed information on Studebaker's 1942 factory delivered prices as compared with similar 1941 models. All prices include Federal excise tax at the rate in effect as of August 18, 1941:

CHAMPION	1942	1941	Increase
Custom Coupe (3-passenger)	\$785	\$710	\$75
Deluxstyle Coupe (3-passenger)	820	745	75
Custom Double-Dater Coupe (5-passenger)	810	750	60
Deluxstyle Double-Dater Coupe (5-pass.)	845	780	65
Custom Club Sedan (two-door)	815	755	60
Deluxstyle Club Sedan (two-door)	850	785	65
Custom Cruising Sedan (four-door)	845	795	50
Deluxstyle Cruising Sedan (four-door)...	880	825	55
COMMANDER			
Custom Sedan-Coupe..	\$1,075	\$990	\$85
Deluxstyle Sedan-Coupe	1,120(none)		
Skyway Series Sedan-coupe	1,155	1,080	75
Custom Cruising Sedan	1,095	1,010	85
Deluxstyle Cruising Sedan	1,140	1,075	65
Skyway Series Cruising Sedan	1,175	1,100	75
Custom Land Cruiser..	1,130	1,055	75
Deluxstyle Land Cruiser	1,175	1,120	55
Skyway Series Land Cruiser	1,210	1,130	80
PRESIDENT EIGHT			
Custom Sedan-Coupe..	\$1,205(none)		
Deluxstyle Sedan-Coupe	1,250(none)		
Skyway Series Sedan-Coupe	1,285	\$1,210	75
Custom Cruising Sedan	1,225	1,140	85
Deluxstyle Cruising Sedan	1,270	1,205	65
Skyway Series Cruising Sedan	1,305	1,230	75
Custom Land Cruiser..	1,260	1,185	75
Deluxstyle Land Cruiser	1,305	1,250	55
Skyway Series Land Cruiser	1,340	1,260	80

1941 Model Has Tax Expectancy of \$600

Because automobiles are made better, are fed an improved diet of gasoline and lubricating oil, and have an easier existence moving over the improved highways that stretch throughout the country, their span of life has increased by one-third during the past decade, reports the American Petroleum Industries Committees. This higher life expectancy, plus higher gasoline tax rates, chiefly the higher duplicating Federal levy, have given a car born in 1941 a tax expectancy of \$600.

"The \$600 that the average car made in 1941 will generate in taxes before it reaches the junk pile exceeds by a wide margin its cost of labor and materials.

LITTELL for FASTER DEFENSE PRODUCTION

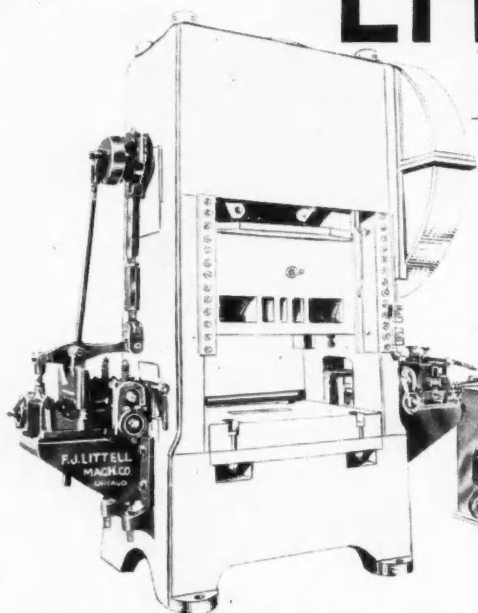


FIG. 1. No. 6-12 1/2 LITTELL Double Rack and Pinion Roll Feed, Straightener and Scrap Cutter shown at left. No. CC20, 2000-lb. capacity, motor-driven Cradle Reel is also shown.

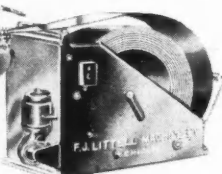


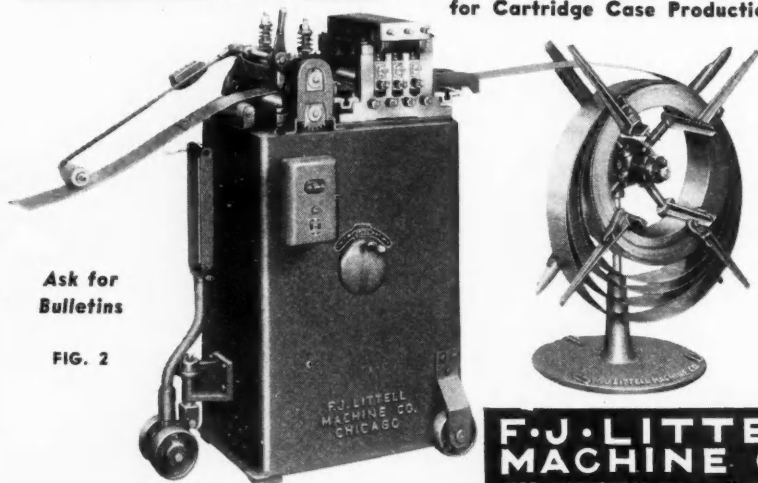
FIG. 1

FASTER Defense Production is assured with LITTELL Double Rack and Pinion Feeds, Automatic Centering Reels, Continuous Straightening Machines and Scrap Cutters, as illustrated. LITTELL also makes other types of Defense Production equipment. LITTELL Feeds are used for blanking and cupping small caliber cartridge cases—

FIG. 2 (below). No. 308 LITTELL Continuous Straightening Machine. Supplies straightened material to automatic punch presses. Handles material up to 8" wide. Speed, 10 to 67 feet per min., using 3/4 h.p. motor. Number and size of straightener rolls used depends on thickness of material. Littell Reel shown is 300-lb. capacity.

producing machine-gun cartridge cases—producing machine-gun cartridge clips—and for blanking and drawing ammunition boxes; also, for various other types of defense production work. Straighteners and Reels supply material to automatic punch presses. REQUEST DETAILS.

LITTELL—manufacturers of Dial Feeds for Cartridge Case Production.



Ask for Bulletins

FIG. 2

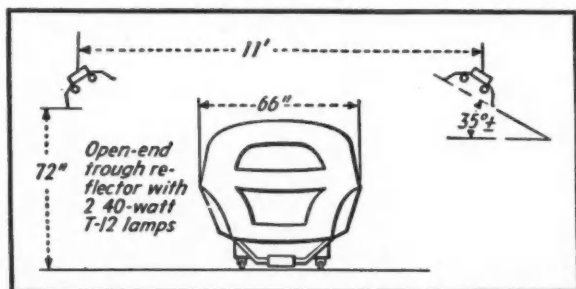
F.J. LITTELL MACHINE CO.
4155 RAVENSWOOD AVE — CHICAGO, ILL.

WESTINGHOUSE supplies the answer



Westinghouse fluorescent fixtures provide adequate light inside the cars as they move along this automobile assembly line.

FLUORESCENT Lighting Makes Inspection Faster, Surer



To deliver constant, controlled illumination on this assembly line, Westinghouse Type FPR open-end units were mounted in two rows eleven feet apart on each side of the line. Reflectors were tilted 35 degrees and were 54 inches apart.

Westinghouse fluorescent lighting fixtures direct controlled light inside the cars on the interior-trim assembly line in this automobile plant. The new lighting system has solved a difficult industrial illumination problem by providing a constant intensity of light within the moving automobile bodies. Inspection is more accurate and is completed in less time than under the original lighting system.

Replacing a series of incandescent angle reflectors, 200 Westinghouse Type FPR-40, open-end porcelain enameled fluorescent fixtures are mounted in two rows along the 750-foot section of the assembly line. The

high-intensity, glareless illumination from the white fluorescent lamps, avoids highlights and eliminates annoying heat.

Providing the exact lighting required for this particular industrial operation is typical of what Westinghouse engineers and lighting equipment can do to help you "supply the answer" for your own lighting needs. Phone your local Westinghouse Lighting Distributor today; or, write Westinghouse Electric & Manufacturing Company, Edgewater Park, Cleveland, Ohio.

117 Westinghouse Electric Supply Company offices and Independent Lighting Distributors provide local stocks and services.

Westinghouse

Lighting Equipment



Industry Curtailment

(Continued from page 148)

executive and president of the Automotive Parts and Equipment Manufacturers Association, affirmed that the trouble is in Washington and not in the manufacturing. He commented:

"I have stood in the offices of the OPM and heard officers of the Army and Navy come in and demand priorities on material that won't be needed until 1943. There are stacks of steel plates stored in some places, and those same stacks are keeping the automobile industry from operating."

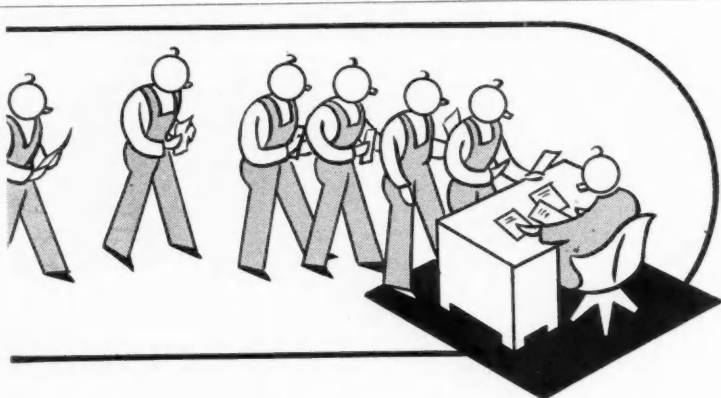
Examples of the automotive indus-

try's co-operation with the Government on defense work were that Murray Body Corp. spent \$100,000 of its own money and sent 70 men to the west coast to study airplane production methods before even receiving a contract, that Hudson expended \$100,000 of company funds to educate its engineering and supervisory personnel in aircraft before getting an order, that Ford laid out complete plans for the bomber plant at Willow Run some time prior to receipt of a letter of intent from the Government, and that the entire expenses of the automotive committee for air defense, which helped locate production facilities for the

bomber procurement program, were borne by the participating companies.

Automotive company representatives who participated in the hearing besides Wilson and Carlton were R. I. Roberge, of Ford; Robert Conder, of Chrysler; C. E. Weiss, of Packard; Robert Waldron, of Hudson; and L. C. Hill, of Murray Body.

Reports submitted to the committee by the automotive companies indicate that considerable unemployment will prevail in Michigan factories next winter unless more defense contracts are forthcoming to absorb the men. Figures prepared by five companies—General Motors, Ford, Chrysler, Hudson and Packard—show that they will have approximately 56,500 less men employed in December in their Michigan plants than are now on the payrolls. These five companies have more than \$2½ billion in defense orders on their books, but more than half of General Motors orders are outside of Michigan and a big portion of the rest are part of the bomber procurement program, which will not really get under way until next spring.



They All Gave the Same Answer - -

- When we asked a number of maintenance men, a while ago, about their hydraulic service problems, they all gave the same answer.

Barnes Hydraulics in their plants require practically no attention, far less by comparison. Consequently production machines equipped with Barnes Hydraulics have less down time, more productive time, than machines equipped with ordinary hydraulics.

That's something for you to think about. If you're not getting full efficiency from your production machines, look into the matter of hydraulics. What you find may surprise you.

And for those new machines you are considering—make sure they're equipped with Barnes Hydraulics. The results will be far more satisfactory.

John S. Barnes Corporation

DETROIT SALES OFFICE
503 NEW CENTER BLDG., TR-1-1706

MAIN OFFICE AND FACTORY
ROCKFORD, ILLINOIS, U. S. A.

Estimates of Unemployment

The five companies reported 83 per cent of their September employment total of 250,910 employees working on non-defense jobs and 17 per cent, or 52,305, on defense work. According to the company estimates for December, there will be approximately 71,800 then working on defense orders, a gain of 37 per cent over the September total, while 174,865 will be employed on civilian consumption, a decline of 31 per cent. This means that unless other defense projects can absorb them, which is unlikely, there will be 56,500 Michigan workers from those five companies unemployed in December.

R. J. Thomas, president of the UAW-CIO, estimated that 150,000 automotive workers would be unemployed by December. John L. Lovett, general manager of the Michigan Manufacturers Association, predicted that Michigan's unemployment would be about 115,000 workers by January. Like others, Governor Murray D. Van Wagoner stressed that the pressing need of Michigan manufacturers is more defense contracts. Unless they are forthcoming and the priorities starvation now affecting the small industries in rural Michigan is relieved, he said, the state faces a welfare and economic problem far worse than in the depth of the last depression.

Walter D. Sayle

Walter D. Sayle, noted Cleveland manufacturer, died recently after a short illness at the age of 81. He was president of the Cleveland Punch and Shear Works, the City Foundry Co., the Cleveland Crane & Engineering Works and the Ohio Machine Tool Co.

New Production Equipment

(Continued from page 88)

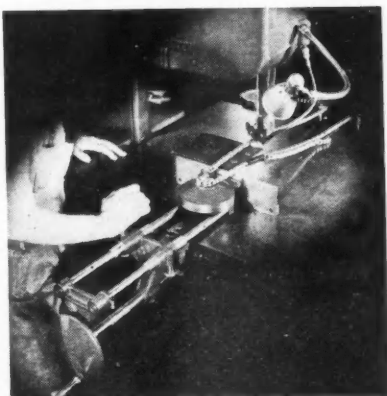
seals and overflow discharge ducts which prevent lubricant from getting onto the clutch plates.

RIPPING, cutting-off and mitering operations are said to be facilitated by the Doall mitering attachment recently announced by Continental Machines, Inc., Minneapolis, Minn. Rods, tubing, bars, gates, channels, rails and other irregular shapes can be handled by this unit, which is adapted to either

and brake. The slide is counter-balanced by air cylinders located in the housings, and the bed is provided with a triple-stage pneumatic cushion. Drive is by V belts from motor to flywheel. The press has a 24-in. stroke, 30-in. adjustment, a 68-in. shut height, and a bed area of 66 in. front to back by 120 in. left to right, and it operates at the rate of 20 strokes per min.

A HEAVY-DUTY adjustable turning head for turret lathes has been

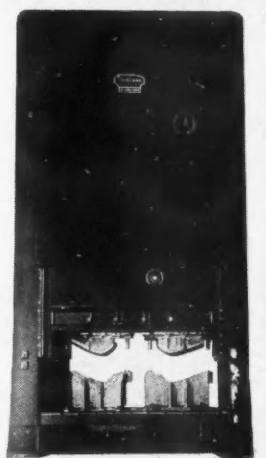
announced by Gisholt Machine Co., Madison, Wis. This tool is designed for turning and boring work, accommodating standard cutter holders in one of the two holes on the slide, as well as additional tool holders in the auxiliary slide mounted at the rear. Provision is made also for the mounting of a drill or boring bar, together with a facing cutter. The main slide is quickly adjusted to size by means of a ball crank handle, fitted with a large micrometer dial and observational clips. A long binder lever rigidly locks the tool slide, permitting heavy, accurate cuts. The auxiliary slide is vertically adjustable.



Showing Doall mitering attachment in use

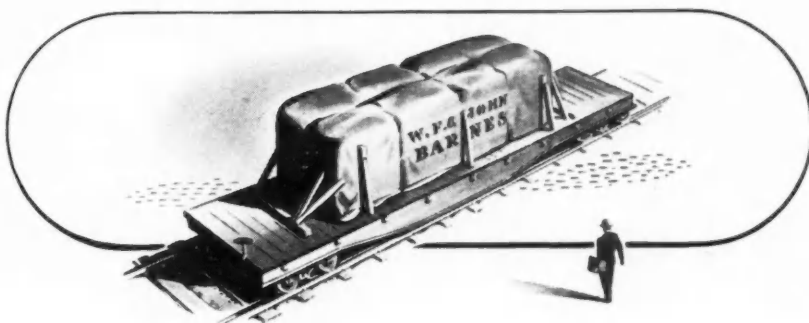
hand or power feed. Being attached to the front instead of the side of the work table, on a sectional guide for full table coverage, the mitering attachment does not interfere with removal of the filler plate. The attachment gives full sawing capacity for complete table coverage, with adjustable stops to limit the stroke as desired.

THE CLEVELAND Four-Point press, a product of The Cleveland Punch & Shear Works Co., Cleveland, Ohio, is symmetrical back and front and exerts a pressure of 1000 tons. The press is triple back-geared, twin-drive and is equipped with two-station electrically controlled air-operated friction clutch

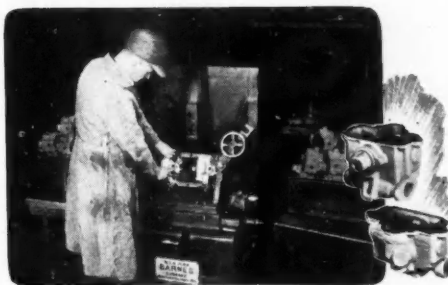


Cleveland Four-Point press

Only for you . . . not John Doe too



● Under the canvas blanket of this flat car rests an idea. To any one but you it's a useless idea. Even your competitors couldn't use it. It's a new *machining method* made possible by the right machine design.



A simple machine licks a tough looking job

● Snuggled inside this small cast-iron housing are two bosses on the same center, but on different levels. To back-face, by coming through the bore from the outside and attaching a facing tool, would be impractical because of the small bore. It would also be too slow.

The machine furnished is designed so that the casting can be slipped over the facing head and fed into depth by hand. Two stations are provided, one for roughing and one for finishing. Both operations are performed simultaneously, resulting in a finished casting every 50 seconds.

You won't have to hunt up jobs for this machine. Its job is already cut out for it. You know exactly what it's going to do, and how much you are going to be able to save with it. You couldn't have bought it from a standard machine tool catalog, but you've been in on the designing of it and have had the chance to eliminate any "production bugs" that have annoyed you in the past.

To the left is an example of the results of our work with a prominent washing machine manufacturer. He didn't restrict the design of his washing machine by designing its parts to fit standard machine tools.

He designed a *good* washing machine and left the *method of machining* up to us.

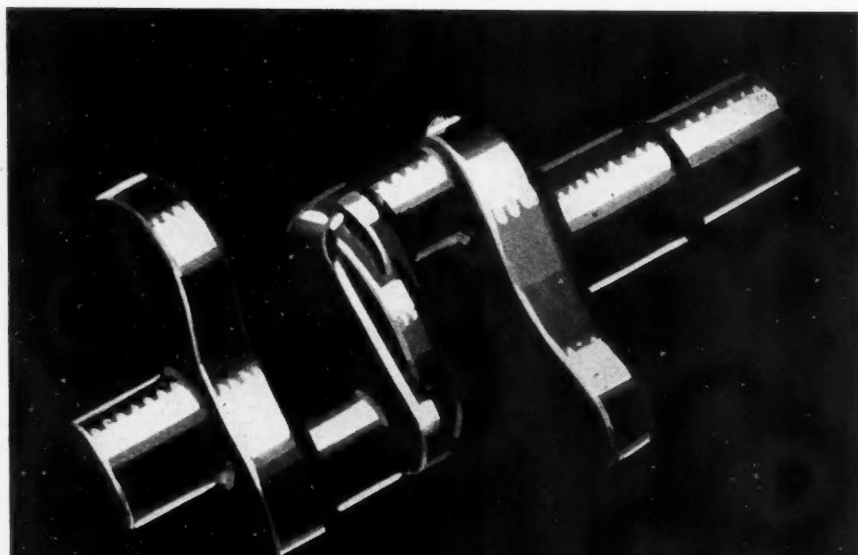
Other examples of our work with various manufacturers are covered in our 3 Point Design bulletins . . . Write for your copies.



Diamond Machine Co., Philadelphia, Pa., announces the development of a new face grinder, known as the "Philadelphia Type," in two sizes. One of the features of the machine is centralization of all controls at a point within easy reach of the operator. The bed has been lengthened, so that the platen never overhangs even in the extreme limit of travel. The ways are farther apart, which ensures a more rigid foundation for the table. The platen, moreover, has been widened, to allow for the mounting of a magnetic chuck or for grinding wider parts. The patented "fluid-tension" table drive, consisting of

power pump, is said to ensure uniform table speed in both directions of travel.

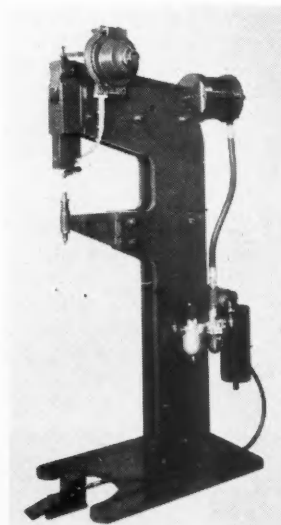
Both models come with the same bed, which measures 229 by 48½ in. The floor space required by each of the machines is 111 in. from front to back and 330 in. from end to end, which allows for table clearance. The speed of the 30-in. wheel is 530 r.p.m., that of the 36-in. wheel, 440 r.p.m. The 30-in. machine will take work 17½ in. high with the front guard in place, and 23½ in. high with the guard removed. Corresponding limits for the 36-in. machine are 23½ in. and 29½ in. Both machines will take work up to 84 in. in length.



It has been the privilege of Wyman-Gordon to participate in the engineering and manufacturing development of aviation, all along the way. Since the dawn of aviation, Wyman-Gordon forgings have been factors in the accomplishment of the reliability of air travel.

Today, with every forging laboratory controlled, Wyman-Gordon is producing crankshafts, cams, propellers and other vital parts, night and day, at full speed.

WYMAN-GORDON
WORCESTER, MASS.
HARVEY, ILL. DETROIT, MICH.



Tomkins-Johnson Rivitor for aircraft work

The Diamond company also has placed on the market a utility hydraulic press, known as the "Diamond 40," suitable for assembling, broaching, straightening, riveting, forcing and pressing operations. It is powered by a high pressure Hele-Shaw pump.

A NEW riveting machine for use in the aircraft industry is in production by the Tomkins-Johnson Co., Jackson, Mich. Pressure for setting the rivets is supplied by an air cylinder and applied (and stepped up) through a toggle mechanism. Feed of the rivets is automatic. By using a different type of rivet set and rivet jaw construction, these machines are said to do an excellent job of flush-riveting. The machine is capable of setting aluminum-alloy rivets up to ¼ in. diameter and ¾ in. length. Tooling design, however, may cut the above-mentioned limit on length. These "Rivitors" are furnished in twelve different throat depths, from 9 in. to 36 in. The ram stroke in all cases is 3 in. The machine is equipped with a 6-in. air cylinder, and an air pressure of 60 lb. is recommended, though less pressure can be used, depending on the size of the rivet being set.

A SINGLE-PURPOSE machine, designed and built by the Moline Tool Co., Moline, Ill., is the No. 23 milling machine which mills spherical clearances in the ends of bolt holes used in tying together the crankcase sections of radial aircraft engines. After the crankcase section has been clamped to the round indexing table, the operator starts the cycle by push-button control, and the holes are milled two at a time, with automatic indexing from one pair of holes to the next, until the work is complete and the cycle stops. Electrical and mechanical interlocking devices prevent the cutters from entering the



As steel orders run, that one was pretty small—in fact, one small bar, weighing but a few pounds, would be plenty.

But its physical properties were sharply specified—so, as far as Columbus, Ohio, was concerned, that particular steel might as well have been platinum.

But the manufacturer had pleasantly discovered that his Mill Supply Salesman could also qualify as a sleuth when needed. So he was

delighted but not surprised when, after a few days, the salesman reported "Your steel is on the way—we found a stock in Scranton."

Have you "discovered" your Mill Supply Distributors in their capacity of helping you to locate supplies of vital materials?

This is but a part of the indispensable services they render in both your buying and your selling. "Cleveland" Tools are marketed through Distributors exclusively.

This incident is typical of the unusual services that many Mill Supply Distributors are rendering their customers during the Emergency.

We favor adequate Preparedness for National Defense

The CLEVELAND **TWIST DRILL COMPANY**
 1242 EAST 49th STREET
 CLEVELAND
TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES
 30 READE ST. NEW YORK 9 NORTH JEFFERSON ST. CHICAGO 650 HOWARD ST. SAN FRANCISCO
 6515 SECOND BLVD., DETROIT LONDON - E. P. BARRUS, LTD. - 35-36-37 UPPER THAMES ST. E.C.4



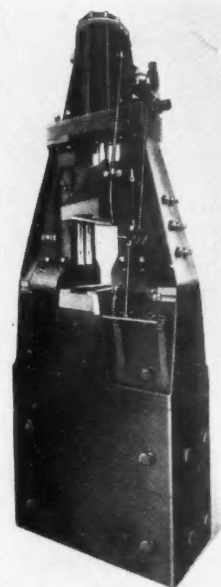
"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

work anywhere except at the desired points, directly over the centers of the holes.

A NEW turret lathe designed for rapid production on chucking operations and bar work has been announced by the South Bend Lathe Works, South Bend, Ind. It has a 16 1/4 in. swing over the bed ways and saddle wings, 9 5/8 in. swing over the tool post saddle cross slide, a 1 3/8 in hole through the head-stock spindle and 1 in. capacity through the collet.

The ram-type turret has both power

feed and hand feed, with automatic indexing and individual stop for each of the six turret faces. A quick-change gear box provides 48 changes of turret power feeds, also 48 changes of both the cross and longitudinal feeds for the tool post carriage and a series of 48 screw threads, 4 to 224 per in. Provision is made for changing the direction and speed of the turret feeds with relation to the carriage feeds. Twelve spindle speeds ranging from 10 to 731 r.p.m. are available. A two-speed motor permits quick change from high to low speed for reaming and tapping operations.



Erie 35000-Lb. Double-Guide Steam Drop Hammer

THE LATEST production of the Erie Foundry Co., Erie, Pa., is the double-guided steam drop hammer illustrated by the accompanying photograph. This machine is rated 35,000 lb., but the same design is available in ratings from 8000 lb. up. In each frame of this type of hammer there are two guides independently adjustable. This arrangement greatly simplifies the problem of preventing angular misalignment of long drop-forging dies. Hammers of this type are being widely used for forging aluminum propeller blades, for long crankshafts, and for a variety of other parts forged from aluminum or steel and entering into air-plane construction.

MEN

(Continued from page 145)

comptroller: **Harry M. Shealey**, factory superintendent; **Carl B. Hamlin**, chief inspector.

A. G. Mulkey is district manager of the newly opened sales office, in the Joseph Vance Bldg., Seattle, Wash., of the Waukesha Motor Co.

Donald G. Dunn, sales promotion and advertising manager of Reynolds Metals Co., has been appointed assistant to the vice president and general sales manager **J. Louis Reynolds**.

Arthur P. Kroeger has been promoted from assistant general branch manager of the Los Angeles office of Monsanto Chemical Co. to assistant manager of sales in charge of intermediates, with headquarters in St. Louis. **Charles L. Fetzner** was transferred from the San Francisco office to Los Angeles to replace Mr. Kroeger.

Fred R. Cooper has been named assistant to the president of Willys-Overland Motors, Inc.

Henry A. Strow has been appointed chief chemist of MacDermid, Inc., of Waterbury, Conn.

Kenneth R. Blake has been appointed chief engineer of Kaydon Engineering Corp.

Dean R. Wilson has been appointed purchasing agent of Copperweld Steel Company's Warren, Ohio, plant.

Frank Wiethoff has been elected president of Chrysler New York Company, Inc., succeeding **William D. Stewart**, retired.

• • • • • Defense,
automotive and
miscellaneous
stampings to your
most rigid
specifications.

• • • skill of an unusual
degree.

• • • dependability that
can result only from 27
years of experience.

• • • equipment that in-
cludes the most modern
stamping and associated
machinery.

• • • efficiency resulting
from our systematic plant
arrangement and
operation.

LANSING STAMPING CO.

1173 SO. PENN AVE., LANSING, MICH.

LANSING STAMPINGS



Linn Tractor equipped with Shuler Front Axle, on 190,000 yards excavation—50% rock.

WHEN THE GOING GETS TOUGH— SHULER AXLES HAVE WHAT IT TAKES!

The tougher the going, the greater the *proof* that Shuler Axles can take a terrific beating—that Shuler construction is best where resistance to shock and strain is of paramount importance!

But there are some other things you'll like, too, about Shuler Axles *and the company that makes them*. For instance—we're not too big for our britches. Even in these trying times, we'll go to any lengths to help a customer. We want your business and are eager to work with you, even if it means the burning of some mid-night oil!

Isn't that the kind of outfit you'd rather deal with?—especially when it is easily proved that the products themselves are unbeatable from *any* standpoint, including price? Give us a chance to *show* you.

SHULER AXLE CO., Incorporated, LOUISVILLE, KY.

Export Division: 38 Pearl St., New York, N. Y.

*West Coast Warehouse: Ford & Derby Sts.
Oakland, Calif.*

BETTER SERVICE!

Many of Shuler's best customers were first won by our eagerness to be helpful in emergencies—such as in rapidly getting out troublesome "specials" and small orders. We invite you to test our cooperativeness on any of our products:

Shuler Square and Tubular Trailer Axles

Shuler I-Beam Trailer Axles for Utility or House Trailers

Shuler Front Axles for Trucks, Tractors, Farm Machinery, etc.

Shuler Truck and Trailer Brakes

Shuler Heavy-Duty Brakes and Trunnion Axles for Low-Platform Heavy-Duty Trailers

Custom Forgings

SHULER

AXLES AND BRAKES

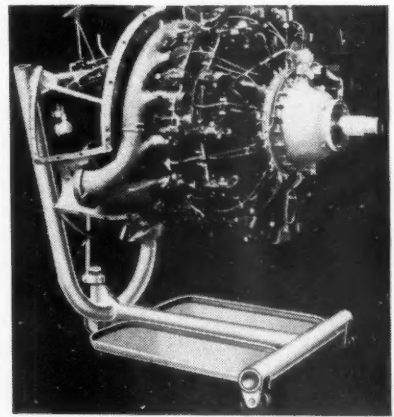
Materials Handling Equipment

(Continued from page 79)

plants. Referring to the accompanying illustration, brass bands 1 in. wide are pressed in position in the band grooves with tire setters, then are delivered by Standard concave roller conveyor to the group of three band-turning lathes. Here a shell body is gripped in a collet chuck and located from the nose end. Using a high-speed-steel form tool, the bands are finish-turned and formed at about 300 feet per minute, using hand feed. Upon completion of the operation,

the shell is removed from the collet chuck and placed on a concave roller conveyor line, which takes it to a bench for final shop inspection. (Illustrated on page 79.)

AN AVIATION department has been established by Whiting Corp. of Harvey, Ill., manufacturers of industrial equipment of various kinds. The company has had more than 50 years' experience manufacturing transporta-



Whiting engine-handling dolly

tion equipment, railroad repair-shop equipment, electric traveling cranes, foundry equipment, chemical equipment, pulverizers, metal-working and special machines. The new aviation department builds special machinery and equipment from customer's drawings. It also offers a service for developing new machines or devices needed in servicing or handling planes and engines and develops time-saving production equipment for the aircraft industry. Typical of the latter line is the engine-handling dolly of which a photograph is reproduced herewith. An engine hoist, engine assembly stand and propeller handling dolly are other items of this line.

NUTS, screws, bushings, couplings and other small parts are quickly accessible when placed in Stack-Units with open bin fronts, a development of the All-Steel-Equip Co., Aurora, Ill. They have full rims and can be stacked at any convenient height without danger of tipping, as shown in the accompanying illustration. The angle corner reinforcements at the top of the bin front are welded to make the latter an integral part of the entire unit. Their accessibility makes them an advantage in either a stock room or assembly department. As uniform width and length permit interchangeable stacking, several capacities are possible in different heights and in gages to suit the weight of the handled material.



Stack-Units of All-Steel-Equip Co. are designed to save time in handling small parts. They are available in a wide range of sizes and engines

Continuous Action

IN MORE WAYS THAN ONE!

Now Built in 3 Sizes
 No. 5—5" dia. round or 5" x 10" flat.
 No. 8—8" dia. round or 8" x 10" flat.
 No. 12—12" dia. round or 12" x 16" flat.

Also the No. 9 Upright Saws

Wells SAWS
 THE SIGN OF SERVICE

NOT only do Wells Metal Cutting Band Saws give you a superior continuous cutting action that means faster, lower cost work . . . they give you the continuous action of day in and day out service for years. They help keep up continuous action in the shop by eliminating bottlenecks, by being available for 1001 metal cutting jobs—bars, sheets, tubes, angles—for production, stock room or maintenance work. Fast, portable, dependable—they're real pace setters. Write for bulletins today.

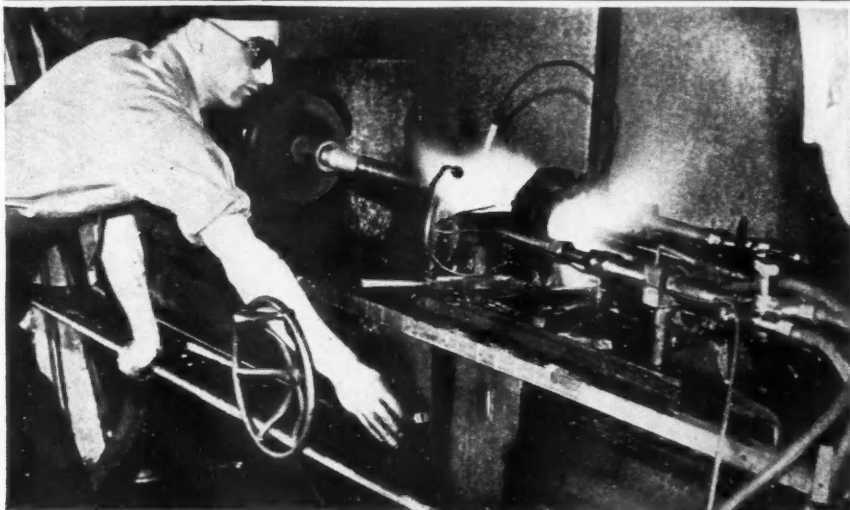
Visit us at the Metal Show—Booth E-54

WELLS MFG. CORP. Three Rivers
 Michigan

Out Went..

EXPENSIVE INNER RACES

when **AIRCO** FLAME HARDENING came in



Flame hardening the shaft. Only the ends require hardening to resist wear on the bearing spots.



Workman examining hardened shafts which are now ready for assembly.

This manufacturer's problem was to increase the service life of a shaft without raising the cost of manufacture. Originally, a softer shaft was used. It was heat treated, then ground to fit inner races which were inserted at each end for bearings. "Now," he says, "thanks to Airco Flame Hardening separate inner races are unnecessary. No longer are expensive heat treating and grinding operations needed. The wearing qualities of the product are vastly improved — yet it costs less to build."

Numerous other hardening applications are helping America build better defense products faster. Representatives of the Airco Applied Engineering Department will be glad to assist you in the proper application of flame hardening to your individual problem.

Air Reduction

General Offices: 60 EAST 42nd ST., NEW YORK, N. Y.

IN TEXAS

MAGNOLIA-AIRCO GAS PRODUCTS CO.

AIRCO DISTRICT OFFICES IN PRINCIPAL CITIES



Anything and Everything for **GAS WELDING or CUTTING and ARC WELDING**

SCRAP-HANDLING operations are performed with a Mercury truck (Mercury Manufacturing Co., Chicago), equipped with a special device designed by the Mercury organization. This heavy-duty, stand-up, center-control fork truck of the A-1480 type has been equipped with a boom and chain device, which permits handling scrap in drums. The drums are picked up and deposited on a large platform trailer, which in turn is towed by the truck through the various operations to the final dumping point.

An illustration on this page shows a Mercury chip-handling truck

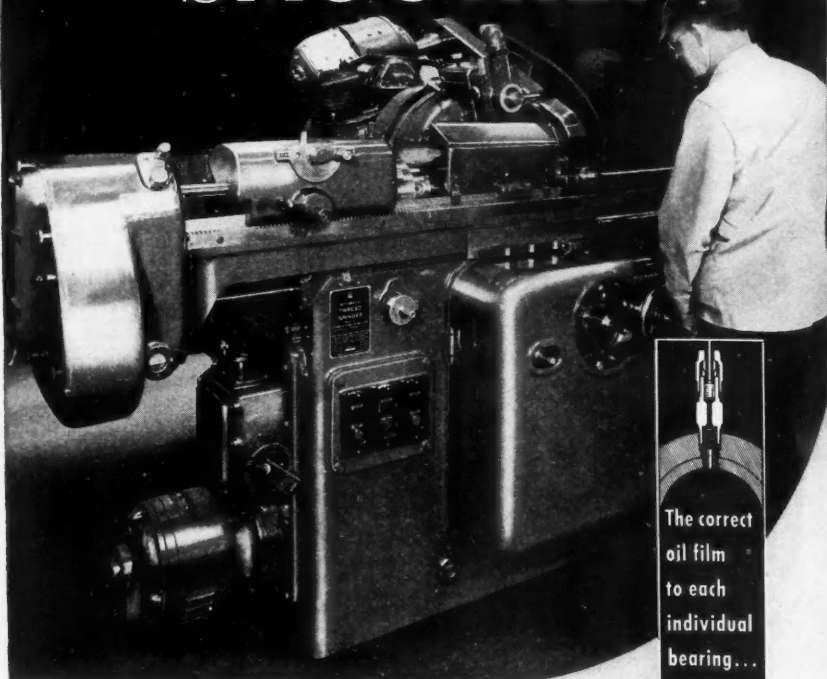
shipped from the factory recently. It is basically a Model A-1364 tilting, telescopic, driver-seated center-control fork truck equipped with a pair of swivel arms mounted on the uprights. This is an electrically-propelled vehicle embodying such features as an hydraulic hoist and tilt, mechanical contactor travel control, an all-welded frame construction, and center control. It is compactly designed for maneuverability.

In the photograph the swivel arms are latched in the non-use position, the truck picking up a steel chip bin, which is then elevated to the proper height and the arms are released to drop for-



Here is shown how a Mercury chip-handling truck picks up the bin and then elevates it into dumping position

...the job done SMOOTHLY



"JONES & LAMSON" Automatic Thread Grinder...with all bearings except grinding wheel spindle Bijur-lubricated.



The correct
oil film
to each
individual
bearing...

automatically

● No time is lost from productive work... a **BIJUR**-equipped machine oils itself, while running! Metered oil-feed—the correct oil-film needed by each individual bearing—is supplied automatically. The efficiency of operator and machine is raised... precision standards are held... maintenance is reduced to a minimum... production stepped up!

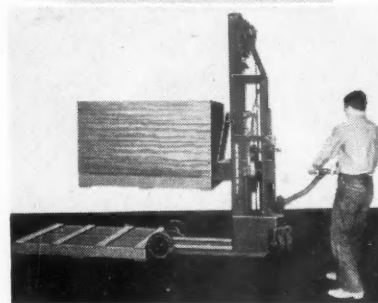
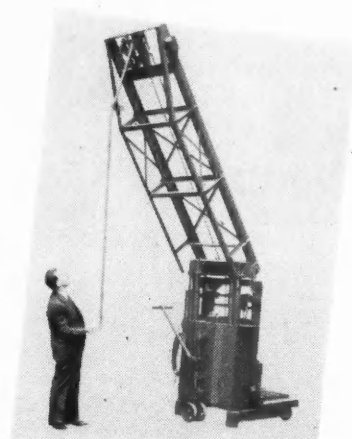
BIJUR LUBRICATING CORPORATION, LONG ISLAND CITY, N. Y.

BIJUR
AUTOMATICALLY *Correct* LUBRICATION

1385

ward at the fixed angle. These arms engage slots on opposite sides of the channel runners supporting the chip bin, and the fork carriage is then lowered. The arms hold the lower rear corner of the bin at a constant height, while the lowering forks permit the nose of the bin to drop forward to a clean dumping angle.

WHAT is described as a transporting pallet stacker has been developed by the Lewis-Shepard Sales Corp., Watertown, Mass. It is intended to take the place of large electric- or gasoline-powered fork-type tiering trucks. A new type of running gear permits the operator to move the stacker up to the pallet and throw the lever, thereby



Lewis-Shepard pallet stacker and spring balanced hinged section (top) for portable elevators

TEXTILE MACHINE PLANT GETS *"Better than Daylight!"*
BY COMBINING G-E MERCURY AND INCANDESCENT LAMPS!

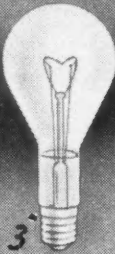


Thirty porcelain enamel reflectors each containing a 400-watt mercury lamp and three 200-watt incandescent lamps light the high bay area. In the low bay areas similar combination units each contain one 250-watt mercury lamp, and three 200-watt incandescent lamps.

THE TEXTILE MACHINE WORKS at Reading, Pennsylvania, gets "better than daylight" illumination by using G-E MAZDA H (mercury) lamps and G-E MAZDA C (incandescent) lamps in combination lighting units in both high and low bays.


Let General Electric show you how you can speed production, reduce errors, and improve morale in your plant with higher level lighting that is "better than daylight" because it is efficient, economical, and dependable 24 hours a day. Your local

electric service company or your G-E MAZDA lamp distributor will show you how to get these higher lighting levels, either with incandescent, mercury, RF, or G-E MAZDA F lamps, or a suitable combination . . . engineered to your needs.




3


GENERAL ELECTRIC MAKES ALL TYPES OF LAMPS to provide "better than daylight" for industrial lighting. These lamps include: (1) G-E MAZDA F (fluorescent) lamps, (2) RF (rectified fluorescent) lamps, (3) MAZDA C (filament) lamps, (4) MAZDA H (Mercury) lamps. See your G-E MAZDA lamp distributor for complete details.



4



1 2

GENERAL  ELECTRIC

braking the wheels. To continue pushing the stacker while the wheels remain stationary, the stacker arms go into the upper pallet and the base member into the lower pallet. The wheelbase is thus reduced from 52 to 19 in. By turning the crank, the load may be raised 6 in. When the operator pulls the stacker toward him the original wheelbase of 52 in. is restored. The accompanying photograph shows the stacker in the transporting position, the running gear having been automatically restored to a wheelbase of 52 in.

A special spring-balance device for easing the raising and lowering of the

hinged section of portable elevators, where fairly frequent hinging operations are necessary, has been made available to industry by the Lewis-Shepard Co. Powerful compression springs within cylinders balance the weight of the upper frame, enabling one man to raise and lower the frame quickly. This spring balance will balance hinged sections 8 ft. and more in length. It can be included on all hinged types of new stackers.

Another new Lewis-Shepard product is an extra-large hydraulic hand-lift truck for handling large machine tools. These trucks can be furnished in capacities up to 35,000 lb.



Baker Model JOM fork truck



• • • Unequalled SURFACE SMOOTHNESS and SPHERICITY

The series of lapping operations performed as a matter of course in the Strom plant give Strom Steel Balls a degree of surface smoothness and sphericity that has always been unequalled in any other regular grade of ball. Only through such unique lapping practice can extreme precision be obtained.

Physical soundness, correct hardness, size accuracy, and sphericity are guaranteed unconditionally in all Strom Balls.

Other types of balls—*stainless steel, monel, brass and bronze*—are also available in all standard sizes. Write for catalog and prices.

Strom

STEEL BALL CO.

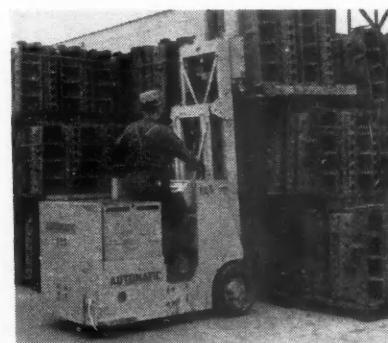
1850 So. 54th Avenue, Cicero, Ill.

The largest independent and exclusive Metal Ball Manufacturer

A NEW addition to the line of industrial trucks manufactured by the Baker Industrial Truck Division of the Baker-Raulang Company, Cleveland, is the JOM center-control fork truck, available in 2000 and 3000-lb. capacities, which was designed specially for operation in narrow aisles and congested areas. All controls are conveniently grouped on a control panel at the operator's left. Hoisting and tilting operations are hydraulically controlled. Lowering is by gravity. The hydraulic lines are of copper tubing and high-pressure, wire-insert, oil-proof hose.

The 2000-lb. capacity truck is furnished to handle loads up to 60 in. in length, the 3000-lb. capacity model up to 42 in. The standard simple lift is 72 in., the standard telescope lift, 119 in. The frame is fabricated of steel by arc-welding and hot riveting, and the main sills are deep-section flange-plate members running from end to end. End guides are channel sections. The fork carriage runs on ball-bearing rollers. Power is supplied by a single hydraulic jack, the piston movement being compounded by a pair of chains and sprockets.

A new Type H-2, Series F Hy-Lift truck, of 4000-lb. load capacity, is another addition to the Baker line. It was



Among the latest materials handling equipment of Automatic Transportation Co. is this telescopic tilting center control fork truck for transporting and tiering unit loads of engine blocks and other machine parts

designed specially for operation in narrow aisles and congested areas. Standard simple lift is 60 in., telescoping lift, 119 in. This new model will operate in aisles 61 in. wide.

platform, which is not shown in the illustration, is 6 ft. wide and 7 ft. long. Lowered height of the platform is 2 ft., elevated height 16 ft. The boom swings 12 in. each side of center and

is operated by hand chain through a worm and gear. The platform and boom are elevated by hydraulic hoist and 3 hp. motor driven hydraulic pump. (Illustrated on page 79.)

Automotive Materials

(Continued from page 147)

Ferrochrome to cast iron in the ladle, with recoveries of 90 per cent and better.

The new alloy is said to dissolve in molten iron more readily than other grades of ferro-chromium, and to go into solution quickly and thoroughly even when the melts are on the cold

side. Finally, because S.M. Ferrochrome dissolves rapidly in the molten metal and gives a uniform distribution of chromium, it prevents the formation of hard spots in the iron caused by incomplete solution. Its complete solution thus facilitates the machining of chromium-bearing castings.

FOLLOWING the recent introduction of its lift-truck model LT-40, Towmotor Co. of Cleveland, Ohio, has brought out a larger, companion model, the LT-44, which is capable of lifting up to 4000 lb. at 15 in. from the carriage. The new model has a 44-in. wheelbase and a turning radius of 72 in., which makes it particularly suitable for use in crowded quarters. The overall width is 35 in. and the over-all length (without forks), 74 in. The truck comes equipped with low, medium and high telescope lifts up to 132 in., thus making possible the use of storage space near ceilings. In addition to the standard load-carrying forks, interchangeable attachments for special pur-



Towmotor LT-44 lift truck in operation

poses, rams, scoops and flat plates are also available.

This new lift truck is powered by a four-cylinder 27½ hp. gasoline engine equipped with degasser and governor. It has a two-speed forward and reverse transmission with only four gear elements, which gives it a speed range of from 1 to 10 m.p.h. Both engine and transmission are easily accessible. It is claimed that the unit will lift and stack its rated load accurately to heights of 7, 9 and 11 ft., at the rate of approximately 40 ft. per min.

THE Lyon-Raymond Corp., formerly under the name of Lyon Iron Works, Greene, N. Y., recently furnished to an aircraft company probably one of the largest hydraulic portable elevators ever built. It is designed for installing or removing engines of large bombing planes. The accompanying illustration shows the elevator in use with a smaller airplane. Its over-all height is 26 ft., length 12½ ft., and width 9 ft.

This elevator has an elevating boom and also a removable elevating platform. The capacity is 5000 lb. The



ONLY LAPPING As Strom Does It CAN PRODUCE SUCH PRECISION

Strom Steel Balls possess a degree of surface smoothness and sphericity that has never been equalled in any other regular grade of ball. Such precision is exclusive with Strom because it can be attained only through a series of lapping operations such as are standard practice in the Strom plant.

Physical soundness, correct hardness, size accuracy and sphericity are guaranteed in all Strom Balls.

Other types of balls—*stainless steel, monel, brass and bronze*, are also available in all standard sizes. Write for complete details.

Strom STEEL BALL CO.

1850 So. 54th Avenue, Cicero, Ill.

The largest independent and exclusive Metal Ball Manufacturer

DEFENSE CONTRACTS

Six-Billion-Dollars worth of contracts—That is the amount of the defense contracts allocated by the Army, Navy, Ordnance Department and Office of Production Management to the automotive industry and those who supply the industry with its needed material, parts and equipment.

In slightly over one year, July, 1940, through July 12, 1941, the automotive industry and its suppliers accepted contracts from the Federal Government to the amount of \$5,843,424,331 for all

types of equipment from buttons to the largest tanks, from nuts, screws and bolts to the largest bombers in the world. These contracts were distributed through approximately 1270 different companies or divisions of companies and represent only those contracts distributed directly by any of the branches of the Federal Government. They do not include any subcontracts that many of these 1270 have received or any of the subcontracts that have been accepted by

hundreds of other automotive manufacturing companies, and are entirely exclusive of any Government loans for plant expansion or equipment.

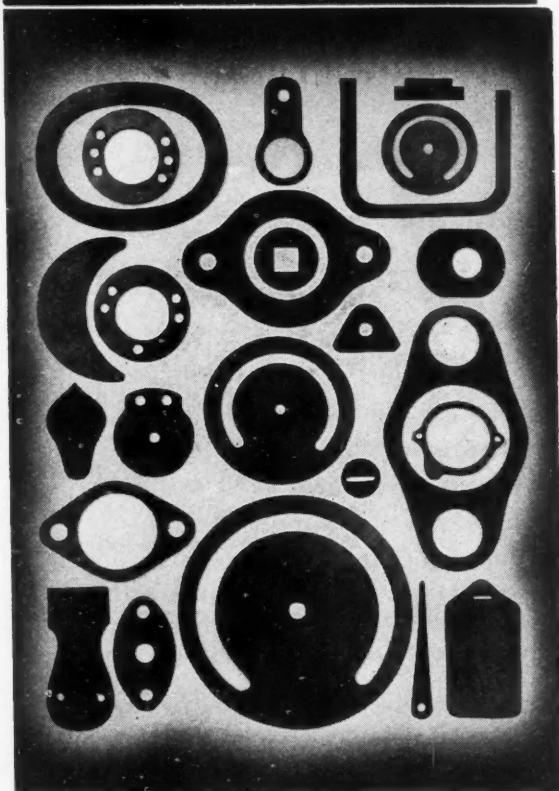
This study is based on official records, obtained originally from the Office of Government Reports and later from the Office of Production Management, which listed the names of all manufacturers who have definite signed orders for the production of items of equipment along with the value of such contracts. From the records of the *Chilton Automotive Buyer's Guide* we were able to select from this total list the names of the manufacturers who are in the automotive industry or are suppliers to it. A complete alphabetical listing along with the cumulative value of their contracts for these companies with orders for over \$10,000, as of July 12, 1941, follows:



Hydraulic Packings

and MECHANICAL LEATHERS

NOTHING TAKES THE PLACE OF *Leather*



"V"
Leather



Cup
Leather



"U"
Leather



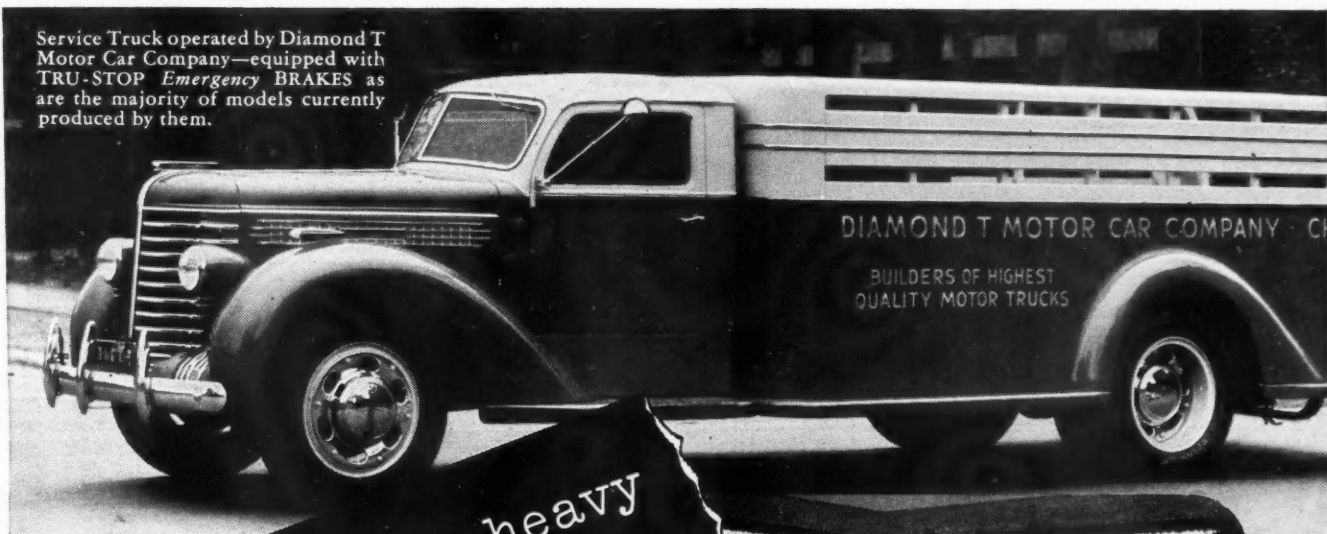
Flange
Leather

Send Us Specifications or Samples for Prices!

EXCELSIOR LEATHER WASHER MFG. CO.
ROCKFORD, ILLINOIS

Name of Company	Products Made	Value of Contract
ABRASIVE MACHINE TOOL CO., East Providence, R. I.; abrasive grinders and milling machines	TOOL	\$169,349
ACME ELECTRIC WELDER CO., Huntington Park, Calif.; spot welding machines.....		11,618
ACME MACHINE TOOL CO., Cincinnati, Ohio; turret lathes		206,647
ADAMS GREASE GUN CORP., N. Y. C.; lubricators.....		79,000
AHLBERG BEARING CO., Chicago, Ill.; ball bearings.....		13,788
AIR CRUISER, INC., Clifton, N. J.; assemblies.....		64,000
AIR REDUCTION SALES CO., N. Y. C.; cylinder regulators, tractor trucks, chemicals		432,860
AIRTHERM MFG. CO., St. Louis, Mo.; tent stoves.....		52,640
AJAX ELECTRIC CO., INC., Philadelphia, Pa.; electric furnaces		21,900
AJAX ELECTROTHERMIC CORP., Trenton, N. J.; electric melting furnaces, volt contractors, asbestos		541,160
AJAX MFG. CO., Cleveland, Ohio; machines		38,368
ALBERTSON & CO., Sioux City, Iowa; tools		39,988
ALEMITE CO., Baltimore, Md.; lubricating guns		12,033
ALLEGHENY FORGING CO., Pittsburgh, Pa.; forgings.....		28,700
ALLEGHENY LUDLUM STEEL CORP., Pittsburgh, Pa.; steel		1,864,112
ALLIS CHALMERS MFG. CO., Milwaukee, Wis.; tractors, engine parts, misc. equipment		8,283,565
ALLITH PROUTY, INC., Danville, Ill.; tool parts.....		93,942
ALL STEEL EQUIPMENT CO., INC., Aurora, Ill.; metal lockers		92,879
ALUMINUM & BRASS CO., Lockport, N. Y.; high pressure cylinder valves.....		13,501
ALUMINUM COMPANY OF AMERICA, Pittsburgh, Pa.; aluminum and aluminum parts		3,363,279
ALUMINUM GOODS MFG. CO., Manitowoc, Wis.; aluminum utensils		727,099
ALUMINUM PRODUCTS CO., La Grange, Ill.; aluminum water pitchers		61,373
AMERICAN BANTAM CAR CO., Butler, Pa.; trucks.....		2,636,302
AMERICAN BOSCH CORP., Springfield, Mass.; magneto assemblies		325,710

Service Truck operated by Diamond T Motor Car Company—equipped with TRU-STOP Emergency BRAKES as are the majority of models currently produced by them.



"Traffic is too heavy to risk using ordinary emergency brakes"



That is the word of an executive of a motor truck company using TRU-STOP Emergency BRAKES as standard on current models.

Possibly that is why more TRU-STOP Emergency BRAKES are being used today than ever before. Possibly that is why more manufacturers of motor trucks and buses today list TRU-STOP Emergency BRAKES as either standard or optional.

We will be glad to discuss the possibilities with you at any time.

TRU-STOP
Emergency
BRAKES



AUTOMOTIVE AND AIRCRAFT DIVISION • 6-235 General Motors Building, Detroit, Michigan • 630 Third Street, San Francisco

AMERICAN CHAIN & CABLE COMPANY, Inc.



THE TRU-STOP "VENTILATED" DISC MAKES TRU-STOP EMERGENCY BRAKES SERVE BETTER AND LAST LONGER

TRU-STOP Emergency BRAKES are disc type brakes that operate on the propeller shaft.

The discs are rugged, drop-forgings. They are ventilated in such manner that the otherwise ruinous heat of braking is dissipated.

Drivers make smooth, safe stops from any speed and use the emergency brake to supplement and save service brakes on long grades. Linings last longer. Brake maintenance costs are lower.

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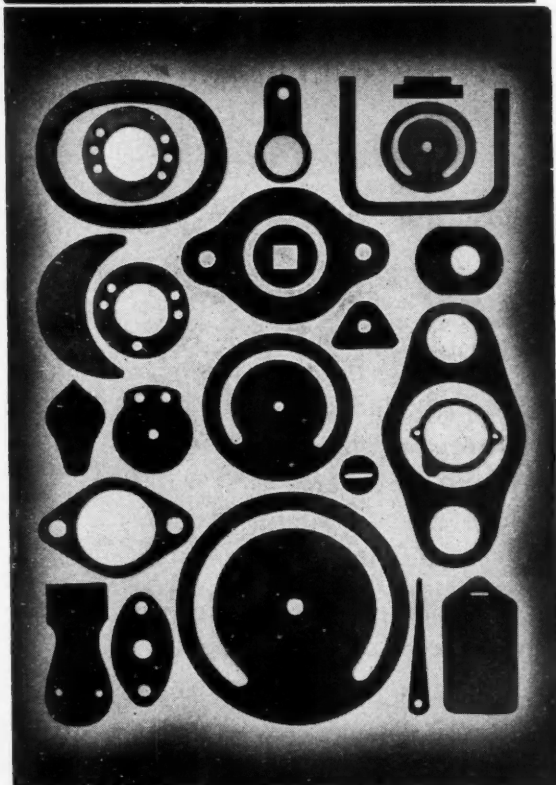
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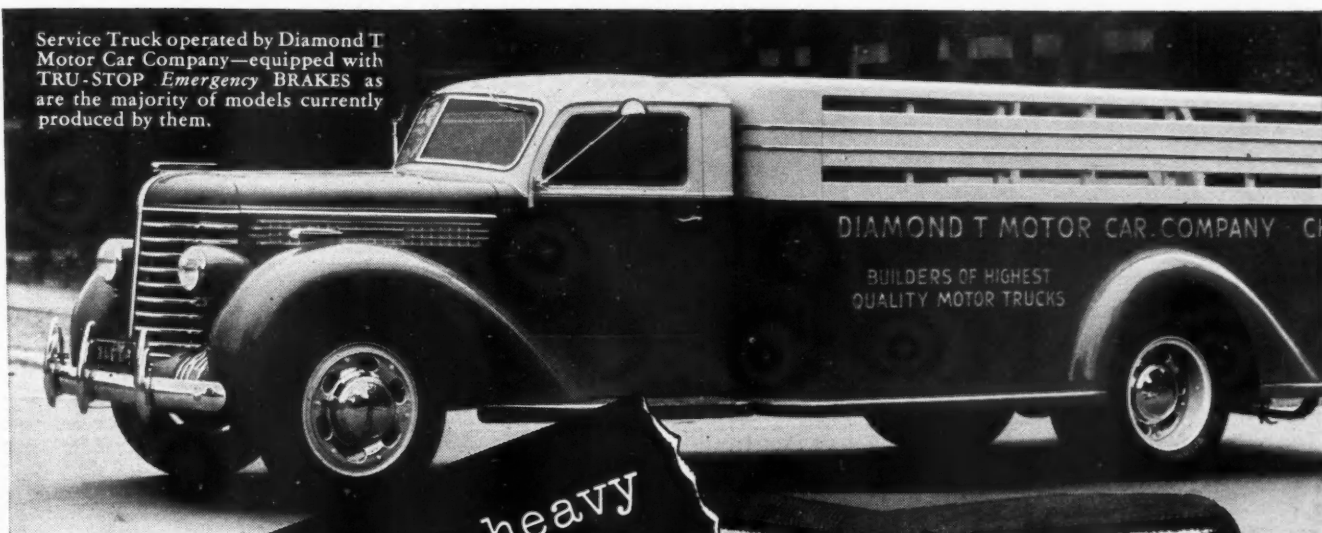
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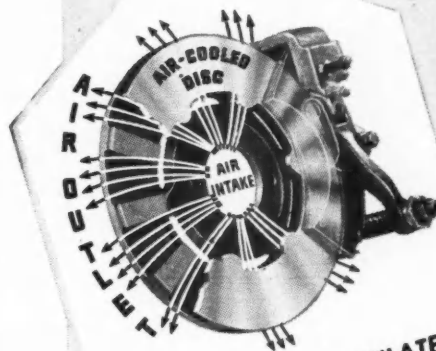
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AMERICAN BRAKE SHOE & FOUNDRY CO.
 AMERICAN FORGE DIV., Chicago, Ill.; ammunition components, forgings 1,255,042
 KELLOGG DIV., Rochester, N. Y.; jigs, guards, castings 11,806
 AMERICAN BRASS CO., Waterbury, Conn.; brass, tubing, ammunition 9,398,171
 AMERICAN BROACH & MACHINE CO., Ann Arbor, Mich.; machines 12,659
 AMERICAN CAN CO., Toledo, Ohio; bases for grates 50,750
 AMERICAN CAR & FOUNDRY CO., New York, N. Y.; tanks and misc. equipment 70,031,762
 J. G. BRILL CO., Philadelphia, Pa.; artillery ammunition 229,034
 AMERICAN CHAIN & CABLE CO.

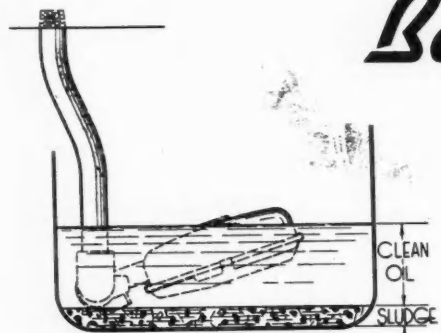
A. C. CAMPBELL DIV., Bridgeport, Conn.; small arms ammunition 82,322
 AMERICAN CHAIN DIV., Bridgeport, Conn.; rings, shackles, tents 381,854
 HAZARD WIRE ROPE DIV., Wilkes-Barre, Pa.; wire rope 34,202
 AMERICAN CABLE DIV., Wilkes-Barre, Pa.; misc. cables 718,198
 PAGE STEEL & WIRE DIV., Monessen, Pa.; welding electrodes 254,962
 AMERICAN CORD & WEBBING CO., New York, N. Y.; cotton webbing 54,539
 AMERICAN CYANAMID & CHEMICAL CO., New York; chemicals 127,776
 CALCO CHEMICAL DIV.,

Bound Brook, N. J.; ammunition components 23,000
 AMERICAN ELECTRICAL HEATER CO., Detroit, Mich.; soldering irons, electric glue pots 11,003
 AMERICAN ENGINEERING CO., Philadelphia, Pa.; windlass, anchor and capstan 517,200
 AMERICAN FELT CO., New York, N. Y.; felt, booster discs 38,397
 AMERICAN FOUNDRY EQUIPMENT CO., Mishawaka, Ind.; blasting equipment 18,729
 AMERICAN HOIST AND DERICK CO., St. Paul, Minn.; hoisting equipment 491,395
 AMERICAN INSTRUMENT CO., Silver Spring, Md.; signal lamps, heliotropes 11,148
 AMERICAN LOCOMOTIVE CO., New York, N. Y.; tanks, forgings, casting machine parts, locomotives 33,577,251
 AMERICAN MANGANESE BRONZE CO., Holmesburg, Phila., Pa.; bronze 27,857
 AMERICAN METAL CO. LTD., New York, N. Y.; solder 39,230
 AMERICAN MONORAIL CO., Cleveland, Ohio; monorail truck section, misc. equipment 632,434
 AMERICAN ROLLING MILL CO., Middletown, Ohio; steel 516,058
 AMERICAN SCALE CO., Kansas City, Mo.; machinists' vises 12,713
 AMERICAN SEATING CO., Grand Rapids, Mich.; metal folding chairs 1,603,792
 AMERICAN SMELTING AND REFINING CO., New York; copper, lead, zinc, solder, bronze 508,693
 FEDERATED METAL DIV., New York; ammunition components 231,314
 AMERICAN STEEL & WIRE CO. OF N. J., Cleveland, Ohio; electric cable, steel, small arms ammunition components, misc. equipment 1,987,971
 AMERICAN STEEL FOUNDRIES, Chicago, Ill.; pins, block 26,281
 AMERICAN TOOL WORKS CO., Cincinnati, Ohio; engine lathes, drills 1,237,085
 AMERICAN TUBE BENDING CO., INC., New Haven, Conn.; spare parts for radial engines 23,171
 AMERICAN WOOLEN CO., New York, N. Y.; cloth, blankets 17,810,333
 AMPCO METAL, INC., Milwaukee, Wis.; small arms material 20,126
 AMTHOR TESTING INSTRUMENT CO., INC., Brooklyn, N. Y.; gage testing outfits 24,790
 ANACONDA WIRE & CABLE CO., New York, N. Y.; electric cable, lamp cord 7,756,826
 ANTHONY CO., Streator, Ill.; platforms, equipment 212,602
 APEX TOOL & CUTTER CO., Shelton, Conn.; cutters 22,874
 APOLLO STEEL CO., Apollo, Pa.; steel 94,400
 AQUA SYSTEMS, INC., New York, N. Y.; gasoline fueling system 2,700,286
 ARCOS CORP., Philadelphia, Pa.; welding electrodes 124,350
 ARMSTRONG BLUM MFG. CO., Chicago, Ill.; cutting machines, saws 36,924
 ARMSTRONG BROS. TOOL CO., Chicago, Ill.; hardware 252,901
 ARMSTRONG CORK CO., Lancaster, Pa.; ammunition components & misc. equipment 1,700,344
 ARO EQUIPMENT CORP., Bryan, Ohio; valve equipment 359,947
 ARQUITO OILLESS BEARING CO., Phila., Pa.; tools 16,085

FLOAT-O

The FLOAT-O Family Keeps Pace with the Automotive Industry

Because



It supplies bearings with the "CREAM" of the OIL from the top of the Crankcase

The sludge, filings and heavy abrasives which cause serious engine wear and inefficiency naturally precipitate to the bottom of the crankcase. FLOAT-O, installed at the pump intake, draws horizontally from the clean oil found at the top . . . it does not disturb the harmful substances found at the bottom of the crankcase. With FLOAT-O only this "cream" of the oil sump is distributed to the bearings. This is true during starting and all running conditions. FLOAT-O is also a definite guarantee against ice-locking. Indorsed and approved by the leading research engineers of the industry, FLOAT-O insures smoother operation and longer life for engines.

Foreign Licensee: British Wire Products, Ltd., London, Eng.

The following outstanding manufacturers use FLOAT-O:

Buda	Gen'l Motors of Canada, Ltd.	Plymouth
Buick	Gen'l Motors Truck & Coach	Seagrave Corp.
Cadillac-LaSalle	International Harvester Co.	Sterling Engine
Chrysler	Lycoming Motors	Studebaker
Chrysler Marines	Morris Motors, Ltd.	White Motors
Continental Motors	Otto Engine	Willys-American
DeSoto	Packard	Witte Engine Works
Dodge Cars and Trucks		Wolseley Motors, Ltd.

Write for literature.

TAYLOR SALES ENGINEERING CO.
 ELKHART INDIANA

Detroit Office 407 Fisher Bldg.



FULLER Helps in Gearing Up America's Defense Program

FULLER'S production program today is closely geared to national defense requirements. Production has been expanded as rapidly as raw materials could be secured, and transmission shipments are arranged in the best possible manner to meet requirements.

Only by expending our facilities to the utmost in close cooperation with the government is it possible for us to best serve our country and the over-all needs of our customers.

We are proud to do our part in gearing up for national defense — proud that FULLER Transmissions, both in strictly military vehicles and in heavy duty trucks moving defense materials, have an important part in filling one of America's most vital needs — TRANSPORTATION.

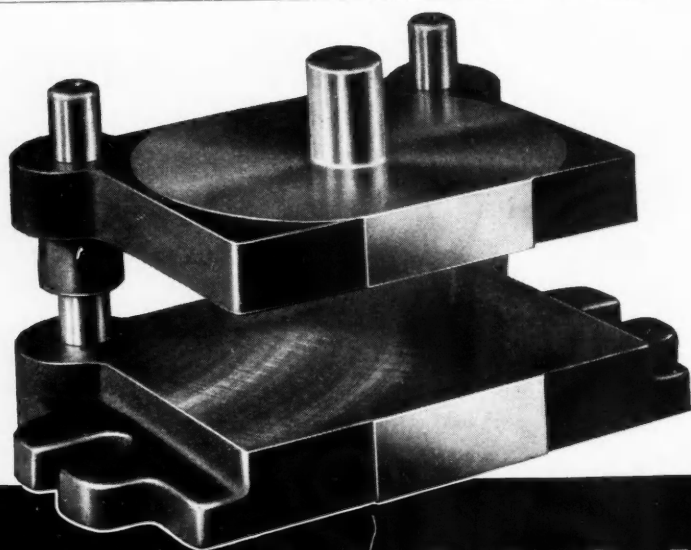
FULLER MFG. CO.
KALAMAZOO, MICHIGAN

FULLER heavy duty
 **Truck Transmissions**

ARROW TOOL & REAMER CO.,
Detroit, Mich.; cutting tools
ARTER GRINDING MACHINE
CO., Worcester, Mass.; grind-
ing machines 21,691
ASSOCIATED SPRING CORP.
WALLACE BARNES DIV.,
Bristol, Conn.; springs, steel,
small arms materiel..... 222,122
ATHOL MFG. CO., Athol, Mass.;
cloth, leather 11,587
E. C. ATKINS & CO., Indian-
apolis, Ind.; butchers' saws
ATLANTIC METAL HOSE CO.,
New York, N. Y.; bronze
steam hose 16,575
ATLAS-ANSONIA CO., New
Haven, Conn.; ammunition
components 543,400
ATLAS BOLT & SCREW CO.,
Cleveland, Ohio; locomotives,
trucks, repair parts for cots
60,985

ATLAS IMPERIAL DIESEL
ENGINE CO., Oakland,
Calif.; unit, generator, ma-
rine diesel engine..... 31,017
ATLAS MFG. CO., New York,
N. Y.; rolls..... 34,968
ATLAS PRESS CO., Kalamazoo,
Mich.; bench shapers..... 11,781
ATLAS TACK CORP., Fair-
haven, Mass.; repair parts
for trunk lockers..... 28,660
ATWATER MFG. CO., Plants-
ville, Conn.; ammunition
components 24,526
AUTOCAR CO., Ardmore, Pa.;
tractor trucks 28,242,518
AUTOMATIC TRANSPORTA-
TION CO., Chicago, Ill.;
high lift crane trucks..... 114,480
AUTO SPECIALTIES MFG. CO.,
St. Joseph, Mich.; ammuni-
tion components 1,692,876

AVIATION MFG. CORP.
LYCOMING DIV.; mainte-
nance parts for engines.... 12,043,401
AXELSON MFG. CO., Los An-
geles, Calif.; engine lathes... 1,539,341
BABCOCK & WILCOX TUBE
CO., Beaver Falls, Pa.; steel
tubing, brick 142,320
BAIRD MACHINE CO., Bridge-
port, Conn.; tools and ma-
chinery 43,257
BAKELITE CORP., New York,
N. Y.; phenolic resin..... 41,540
BAKER-LOCKWOOD MFG. CO.,
Kansas City, Mo.; tents..... 177,734
BAKER-RAULANG CO., Clevel-
and, Ohio; electric crane
trucks 141,652
BALDWIN LOCOMOTIVE
WORKS, Eddystone, Pa.;
tanks, misc. equipment.... 37,117,296
BALTIMORE PAINT & COLOR
WORKS, INC., Baltimore,
Md.; paint 133,360
BARBER COLMAN CO., Rock-
ford, Ill.; cutters and misc.
tools 104,202
BARBOUR STOCKWELL CO.,
Cambridge, Mass.; automo-
tive equipment 28,501
BARCALO MFG. CO., Buffalo,
N. Y.; repair parts for cots... 251,887
BARKER TOOL DIE & GAUGE
CO., Detroit, Mich.; gages... 49,510
BARNES MFG. CO., Mansfield,
Ohio; bronze pipe flanges... 82,686
W. F. & JOHN BARNES CO.,
Rockford, Ill.; drilling ma-
chines, tools 75,432
BARNHARDT MFG. CO., Char-
lotte, N. C.; surgical dress-
ings 88,135
BATAVIA MILLS, INC., New
York, N. Y.; towels, sheet-
ing, table cotton damask.... 247,584
BATES CHEVROLET CORP.,
New York, N. Y.; automo-
biles and trucks..... 12,081
JOHN BATH & CO., INC.,
Worcester, Mass.; gages,
taps 24,205
BAUER & BLACK, Chicago,
Ill.; absorbent cotton, gauze
bandages, adhesive tape.... 441,378
BAUSCH & LOMB OPTICAL
CO., Rochester, N. Y.; misc.
lens equip., fire equip. in-
struments, glass plates..... 3,332,884
BAY CITY SHOVELS, INC.,
Bay City, Mich.; motor truck
crane 63,080
BAY STATE ABRASIVE PROD-
UCTS CORP., Westboro,
Mass.; grinding wheels, bot-
tles with chemicals..... 18,709
BEALS & SELKIRK TRUNK
CO., Wyandotte, Mich.;
trunks, lockers 77,325
BEARINGS CO. OF AMERICA,
Lancaster, Pa.; ball bearings
..... 17,041
BEECH AIRCRAFT CORP.,
Wichita, Kan.; airplanes and
spare parts 81,655,101
BEHR MANNING CORP., Troy,
N. Y.; garnet paper, sharp-
ening stones 197,908
BELL AIRCRAFT CORP., Buf-
falo, N. Y.; airplanes and
spare parts 49,902,333
BELMONT SMELTING & RE-
FINING WORKS, INC.,
Brooklyn, N. Y.; copper in-
gots, flaked aluminum..... 12,242
BENDER BODY CO., Cleveland,
Ohio; mess equipment..... 398,900
BENDIX AVIATION CORP.,
South Bend, Ind.; ammuni-
tion components, carburetor
bodies 10,285,041
ECLIPSE AVIATION DIV.,
Bendix, N. J.; automotive
equipment, artillery mate-
riel, fire control equip., tank
parts 30,050,006
ECLIPSE MACHINE DIV.,
Bendix, N. J.; ammunition
and misc. equipment..... 6,419,457
JULIAN P. FRIEZ & SONS
DIV., Baltimore, Md.; bear-
ings, misc. equipment..... 51,979

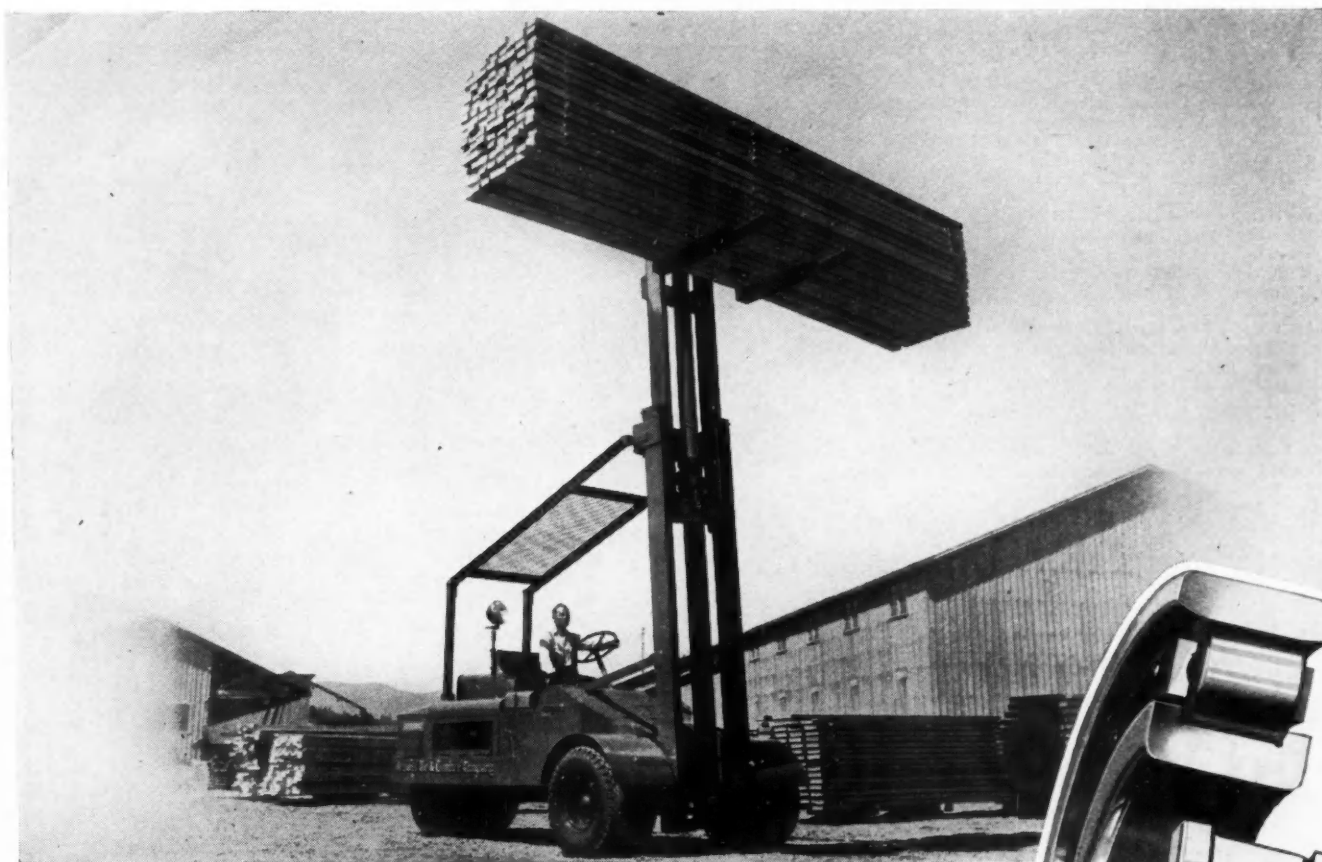


PRECISION
IS THE KNOWN QUANTITY
OF DEPENDABLE ACCURACY
THAT SAVES MONEY IN
DIE MAKING—AND
STAMPING PRODUCTION

WRITE YOUR DANLY BRANCH
DANLY MACHINE SPECIALTIES, INC.
2100 So. 52nd Ave. • Chicago, Ill.

513 E. Buffalo Street, Milwaukee, Wis. 1549 Temple Avenue, Detroit, Mich.
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990 E. Monument Ave., Dayton, Ohio 1745 Rockwell Ave., Cleveland, Ohio
3913 North Broad St., Philadelphia, Penna.
Ducommun Metals & Supply Company, Los Angeles, Calif.; San Francisco, Calif.

DANLY DIE SETS and DIE
MAKERS' SUPPLIES



Records show that these Gerlinger Trucks, built by Dallas Machine & Locomotive Works and equipped throughout with antifriction bearings mounted in oil-sealed housings, have traveled 2000 miles a month, and have handled 450 loads of lumber in an eight-hour shift.

Get a Lift

FROM SKF-EQUIPPED TRUCKS

Moving lumber for cantonments, new factories, etc., in its way is just as important as placing big guns along our shores and planes in our skies. For machines that make defense weapons must be *protected* to be *effective*, and the rapid movement of materials contributes to SPEED. So Gerlinger Lift

Trucks are doing their bit by lifting a truck load of lumber 10" a second as easily as you'd doff your hat. They're saving construction time on defense with SKF Bearings. Wherever a machine is on defense work, chances are it depends on SKF Bearings.

SKF INDUSTRIES, INC., PHILA., PA.

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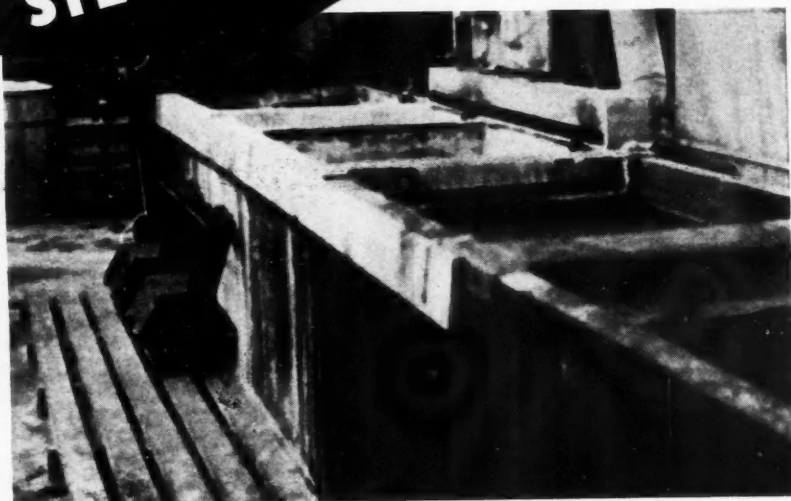
ROLLER SKF BEARINGS

MARINE DIV., Brooklyn, N. Y.; fire control equipment 282,142
 BENDIX PARTS DIV., South Bend, Ind.; wheel assemblies 295,761
 PECO MFG. CO., Philadelphia, Pa.; ammunition components 1,389,365
 PIONEER INSTRUMENT DIV., Bendix, N. J.; airplane parts 18,534,329
 BENDIX PRODUCTS DIV., South Bend, Ind.; wheel and brake assemblies 16,168,663
 BENDIX RADIO CORP., Baltimore, Md.; radio instruments 7,243,946
 SCINTILLA MAGNETO DIV., Sidney, N. Y.; magnetos and misc. parts 682,146
 BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE

CO., Pittsburgh, Pa.; parts for brake 46,352
 OTTO BERNZ CO., INC., Rochester, N. Y.; gasoline torches 22,918
 BERTSCH & CO., INC., Cambridge City, Ind.; rolling machines 92,598
 BETHLEHEM STEEL CO., Bethlehem, Pa.; steel 21,041,355
 B. G. CORP., New York, N. Y.; automotive equipment 629,987
 BIEDERMAN MOTORS CORP., Cincinnati, Ohio; truck tractors 973,639
 BILLINGS AND SPENCER CO., Hartford, Conn.; clamps, milling machines 50,329
 BIRDSBORO STEEL FOUNDRY & MACHINE CO., Birdsboro, Pa.; hydraulic press 56,040

BISHOP WIRE & CABLE CORP., New York, N. Y.; electric cable 93,231
 BLACK & DECKER MFG. CO., Towson, Md.; drills and grinders 22,792
 BLACKHAWK MFG. CO., Milwaukee, Wis.; jack assemblies 673,204
 G. S. BLAKESLEE & CO., Chicago, Ill.; machines 105,827
 N. J. BLANCHARD BOAT CO., Seattle, Wash.; aircraft rescue boats 142,234
 BLANCHARD MACHINE CO., Cambridge, Mass.; surface grinders 23,629
 BLAW KNOX CO., Pittsburgh, Pa.
 UNION STEEL CASTINGS DIV., Pittsburgh, Pa.; castings 1,311,880
 S. BLICKMAN, INC., Weehawken, N. J.; coffee urns 28,926
 BLISS & LAUGHLIN, INC., Buffalo, N. Y.; bar steel machinery 36,256
 E. W. BLISS CO., Brooklyn, N. Y.; presses and misc. machines 377,094
 J. G. BLOUNT CO., Everett, Mass.; lathes 15,851
 BOEING AIRCRAFT CO., Seattle, Wash.; bombing planes & spare parts 164,930,251
 BOHN ALUMINUM & BRASS CO., Detroit, Mich.; ammunition components 1,366,560
 BONNEY FORGE & TOOL WORKS, Allentown, Pa.; tools 82,385
 BORG WARNER CORP.
 INGERSOLL STEEL AND DISC DIV., Chicago, Ill.; artillery ammunition 7,625,984
 MECHANICS UNIVERSAL JOINT DIV., Rockford, Ill.; magazines, fuse 1,837,100
 ROCKFORD DRILLING MACHINE DIV., Rockford, Ill.; misc. engine parts 245,987
 MARVEL SCHEBLER CARBURETOR DIV., Flint, Mich.; track controls 238,242
 BOSTON INSULATED WIRE & CABLE CO., Dorchester, Mass.; electric cable 105,129
 BOSTON WOVEN HOSE & RUBBER CO., Boston, Mass.; hose and misc. equipment 352,861
 BOSSERT CO., Utica, N. Y.; cartridge cases 1,290,000
 BOWEN PRODUCTS CORP., Ecorse, Mich.; soldering equipment 1,104,387
 BOYLE MFG. CO., Los Angeles, Calif.; steel drums 81,132
 BOYERTOWN AUTO BODY WORKS, INC., Boyertown, Pa.; trailers and bodies 21,532
 BRADFORD MACHINE TOOL CO., Cincinnati, Ohio; lathes 246,965
 BREEZE CORP., INC., Newark, N. J.; automotive equipment 2,037,191
 BREWSTER AERONAUTICAL CORP., L. I. City, N. Y.; airplanes 19,722,099
 BRIDGEPORT BRASS CO., Bridgeport, Conn.; brass 8,792,455
 BRIDGEPORT FABRICS, INC., Bridgeport, Conn.; O. D. cotton webbing 12,812
 BRIDGEPORT THERMOSTAT CO., INC., Bridgeport, Conn.; ammunition 482,554
 BRIGGS & STRATTON CORP., Milwaukee, Wis.; ammunition components 2,520,910
 BRISTOL AIRCRAFT CORP., Bristol, Va.; life floats 193,322
 BRODERICK AND BASCOM ROPE CO., St. Louis, Mo.; nautical equipment 177,243
 BROWN & SHARPE MFG. CO., Providence, R. I.; machines and tools 1,877,151
 BROWN INSTRUMENT CO., Philadelphia, Pa.; misc. instruments 27,957

**FOR
BLACKENING
STEEL PARTS**



On a Production Basis!

● Pictured above is a commercial HOUGHTO-BLACK installation in a large Chicago plating company, which illustrates how the simplicity of this low cost process makes it readily adaptable to production line work.

Comprising a single-bath treatment at 290°-295° F., the HOUGHTO-BLACK method offers a process which gives steel parts an even, lustrous black color, resisting oxidation and improving appearance. Ask the Houghton Man, or write for factual folder at right.

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The Inside Story of Accurate Service . . .

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SPRINGS
WIREFORMS
STAMPINGS
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HERE'S a glimpse behind the scenes at the Accurate plant of a few of the hundreds of whirring machines and lightning-fast fingers that are fighting time day and night to give you springs when you need them. It's a combination of speed, precision, care and efficiency, with never an idle spot or moment.

It's a juggling of time, material, space, men and machines. It's the reason why you can count on Accurate's delivery promises.

Come to Accurate for springs, wireforms and stampings. You'll see what we mean.



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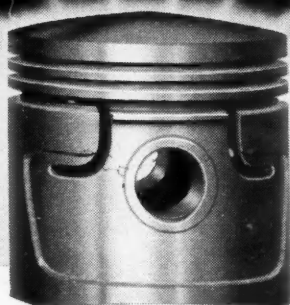
3811 W. Lake St.
Chicago, Illinois.

CHARLES BRUNING CO., INC.,
Chicago, Ill.; photography
instruments 39,991
**BRYANT CHUCKING GRIND-
ER CO.**, Springfield, Vt.;
grinding machines 63,812
**BRYANT MACHINERY & EN-
GINEERING CO.**, Chicago,
Ill.; machines 47,715
BUCYRUS-ERIE CO., South
Milwaukee, Wis.; well drill-
ing machines 115,774
BUDA COMPANY, Harvey, Ill.;
engines & machines 8,764,908
**GUIBERSON DIESEL EN-
GINE DIV.**, Chicago, Ill.;
diesel engines 4,307,350
EDWARD G. BUDD MFG. CO.,
Phila., Pa.; machinery &
ammunition 7,459,393
BUDD WHEEL CO., Detroit,
Mich.; ammunition parts.... 15,506,784

BUFFALO BOLT CO., N. Tona-
wanda, N. Y.; ammunition
components 56,395
BUFFALO FORGE CO., Buffalo,
N. Y.; bending roll..... 339,563
BUFFALO SCALE CO., INC.,
Buffalo, N. Y.; weighing
scales 19,250
BUHL STAMPING CO., Detroit,
Mich.; milk cans, mines.... 285,600
BUILDERS IRON FOUNDRY,
Providence, R. I.; boring
lathes 62,000
BULLARD CO., Bridgeport,
Conn.; turret lathes..... 5,265,138
BURGESS NORTON MFG. CO.,
Geneva, Ill.; bodies block... 38,489
BURKE ELECTRIC CO., Erie,
Pa.; generators 98,995
BURTON DIXIE CORP., Brook-
lyn, N. Y.; feather pillows... 89,781

BUSS MACHINE WORKS, Hol-
land, Mich.; surfacers..... 31,088
W. E. CALDWELL CO., Louis-
ville, Ky.; rifle range equip-
ment 34,000
**CAMBRIDGE INSTRUMENT
CO.**, New York, N. Y.; indi-
cator assemblies 198,480
CAMDEN FORGE CO., Camden,
N. J.; bar steel..... 65,795
**CAMPBELL WYANT & CAN-
NON FOUNDRY CO.**, Mus-
kegon Heights, Mich.; am-
munition parts 98,880
CANDLER HILL CORP., De-
troit, Mich.; automotive
equipment 146,837
**CARBIDE & CARBON CHEMI-
CALS CORP.**, New York,
N. Y.; chemicals..... 451,641
CARBOLOY CO., INC., Detroit,
Mich.; tools and ammunition
CARBORUNDUM COMPANY,
Niagara Falls, N. Y.; sharp-
ening stones 130,370
PHILIP CAREY CO., Lockland,
Ohio; magnesia plaster..... 15,220
**CARLTON MACHINE TOOL
CO.**, Cincinnati, Ohio; drills
**CARNEGIE ILLINOIS STEEL
CORP.**, Pittsburgh, Pa.; steel
**AMERICAN STEEL & WIRE
CO.**, Cleveland, Ohio; steel
for ammunition 62,383
CARPENTER STEEL CO.,
Reading, Pa.; tool steel.... 588,865
CARRIER CORP., Syracuse,
N. Y.; air conditioning units
CARTER CARBURETOR CORP.,
St. Louis, Mo.; artillery am-
munition components 1,335,536
CASCO PRODUCTS CORP.,
Bridgeport, Conn.; primers.. 100,908
J. I. CASE CO., Racine, Wis.;
ammunition components ... 4,799,560
CATERPILLAR TRACTOR CO.,
Peoria, Ill.; tractors..... 1,518,538
CELLULOID CORP., New York,
N. Y.; plastic sheets, cups.. 18,572
CENTURY BOAT CO., Manistee,
Mich.; boats 98,800
CESSNA AIRCRAFT CO.,
Wichita, Kan.; training
planes 900,378
CHAIN BELT CO., Milwaukee,
Wis.; artillery material.... 2,747,708
**CHAMBERSBURG ENGINEER-
ING CO.**, Chambersburg,
Pa.; hammers, machines... 127,537
**CHAMPION MACHINE & FORG-
ING CO.**, Cleveland, Ohio;
Forgings 8,091
CHAMPION SPARK PLUG CO.,
Toledo, Ohio; spark plugs... 2,598,411
CHAPMAN VALVE MFG. CO.,
Indian Orchard, Mass.;
bronze gate valves..... 107,160
CHASE BRASS & COPPER CO.,
Waterbury, Conn.; brass,
ammunition parts 9,344,498
CHATHAM MFG. CO., Elkin,
N. C.; green woolen blankets
JOHN CHATILLON & SONS,
Fulton, N. Y.; mess equip-
ment and supplies..... 10,501
**CHICAGO FLEXIBLE SHAFT
CO.**, Chicago, Ill.; fuses.... 901,529
**CHICAGO METAL HOSE
CORP.**, Maywood, Ill.; hoses
**CHICAGO PNEUMATIC TOOL
CO.**, New York, N. Y.; elec-
trical equipment 842,349
**CHISHOLM MOORE HOIST
CORP.**, Tonawanda, N. Y.;
chain hoists 42,901
CHRIS CRAFT CORP., Algonac,
Mich.; boats 234,019
CHRYSLER CORP., Detroit,
Mich.; tanks, forgings 33,908,837
FARGO MOTOR CORP., De-
troit, Mich.; trucks, cars
**CINCINNATI BALLCRANK
CO.**, Cincinnati, Ohio; am-
munition components 204,068
**CINCINNATI BICKFORD TOOL
CO.**, Cincinnati, Ohio; drill-
ing machines 864,919
**CINCINNATI ELECTRIC TOOL
CO.**, Cincinnati, Ohio; buf-
fers, polishers & grinders .. 160,708

STERLING PISTONS



CONFIDENCE BORN OF EXPERIENCE

Sterling Pistons are backed by confidence in a company "years" old in the piston industry.

Collaborated Engineering — Patented Pouring Process — Controlled Production and *YEARS OF KNOWING HQW* have produced pistons worthy of that confidence. Sterling pistons are designed to do the job better.

**STERLING ALUMINUM
PRODUCTS, INC.
SAINT LOUIS**

We'd like to say "YES!"

When a friend needs your help—needs it urgently—you like to say "YES!"

But sometimes, for unavoidable reasons, you are forced to say "NO!"

How you hate to say it!

That's the way we feel today.

Here we are, turning out millions of tons of steel—more than ever before in Republic's history.

Yet, to many of our friends—our customers who have learned to depend upon us for steel—we may have to say "NO" when we'd like to say "YES."

The reason is well known. World affairs demand that we build for defense—defense

for your business, your possessions, your home, your family. And modern equipment for defense requires steel—quickly and in unprecedented quantities.

Republic must—*AND WILL*—supply first the steel needed for defense purposes.

At the same time, we want to be fair to *ALL* our other customers in apportioning steel available for non-defense use.

If we have said "NO" to you—or if we must in the future—just remember that we don't want to say it—we'd like to say "YES."

And remember, too, that the steel you can't get is the steel that is being used to protect all of us against an uncertain future.

REPUBLIC STEEL CORPORATION

General Offices: Cleveland, Ohio

Berger Manufacturing Division
Culvert Division
Niles Steel Products Division



Steel and Tubes Division
Union Drawn Steel Division
Truscon Steel Company

ALLOY and CARBON STEELS • STAINLESS STEEL • PLATES
BARS and SHAPES • STRIP • SHEETS • PIPE and TUBING

TIN PLATE • NUTS • BOLTS • RIVETS • NAILS • PIG IRON
FARM FENCE • WIRE • FABRICATED STEEL PRODUCTS

CINCINNATI GILBERT MACHINE TOOL CO., Cincinnati, Ohio; milling, boring, drilling machines 28,650

CINCINNATI MILLING MACHINE & CINCINNATI GRINDERS, INC., Cincinnati, Ohio; machines 2,615,714

CINCINNATI PLANNER CO., Cincinnati, Ohio; planers .. 74,985

CINCINNATI SHAPER CO., Cincinnati, Ohio; machines.. 203,405

CINCINNATI TOOL CO., Cincinnati, Ohio; pontoon equipment 130,637

CLARK CONTROLLER CO., Cleveland, Ohio; junction box straps 228,763

CLARK EQUIPMENT CO., Buchanan, Mich.

CLARK TRACTOR DIV., Battle Creek, Mich.; tractors 2,026,537

CLAYTON & LAMBERT MFG. CO., Detroit, Mich.; torches 11,083

CLAYTON MFG. CO., Alhambra, Cal.; steam generating units and spare parts..... 125,394

CLEARING MACHINE CORP., Chicago, Ill.; presses..... 92,200

CLEMONS BROS., INC., Middletown, N. Y.; hacksaw blades 10,253

CLEVELAND AUTOMATIC MACHINE CO., Cleveland, Ohio; machines 225,133

CLEVELAND CONTAINER CO., Cleveland, Ohio; artillery ammunition 92,491

CLEVELAND PNEUMATIC TOOL CO., Cleveland, Ohio; air hose couplings..... 2,847,046

CLEVELAND TRACTOR CO., Cleveland, Ohio; light tractors, tractor parts..... 16,168

CLEVELAND TRENCHER CO., Cleveland, Ohio; trench diggers 27,075

CLEVELAND TWIST DRILL CO., Cleveland, Ohio; tools.. 48,989

CLEVELAND WELDING CO., Cleveland, Ohio; ammunition components 449,820

CLIFTON MFG. CO., Waco, Texas; tents, barrack bags.. 167,518

CLIMAX ENGINEERING CO., Clinton, Iowa; power units.. 213,944

CLIMAX MOLYBDENUM CO., New York, N. Y.; ferro molybdenum 13,465

CLOVER MFG. CO., Norwalk, Conn.; cloth, abrasive..... 26,536

CLYDE IRON WORKS CO., Duluth, Minn.; steam driven winches 375,005

C-O-TWO FIRE EQUIPMENT CO., Newark, N. J.; fire equipment 541,659

COLONIAL BROACH CO., Detroit, Mich.; broach sections 30,790

COLSON CORP., Elyria, Ohio; stand assemblies 60,490

ARTHUR COLTON CO., Detroit, Mich.; tablet machines 120,617

COLT'S PATENT FIRE ARMS MFG. CO., Hartford, Conn.; small arms materiel..... 30,939,380

COLUMBIA STEEL & SHAF- TING CO., Carnegie, Pa.; steel bars 109,895

COLUMBIAN STEEL TANK CO., Kansas City, Mo.; steel buildings 344,478

COLUMBUS BOLT WORKS CO., Columbus, Ohio; wedges 42,491

COLUMBUS McKINNON CHAIN CORP., Tonawanda, N. Y.; coil chain 21,498

COMMERCIAL SHEARING & STAMPING CO., Youngs- town, Ohio; end plates..... 10,860

COMMERCIAL SOLVENTS CORP., New York, N. Y.; ethyl alcohol 99,090

CONE AUTOMATIC MACHINE CO., Windsor, Vt.; screw machines 56,728

CONGOLEUM-NAIRN, INC., Kearny, N. J.; battleship linoleum 179,688

CONNECTICUT TELEPHONE & ELECTRIC CO., Meriden, Conn.; headsets 474,860

CONSOLIDATED AIRCRAFT CORP., San Diego, Cal.; air- planes 582,984,926

CONSOLIDATED INSTRU- MENT CORP., Michigan City, Ind.; speed indicator sets 10,074

CONSOLIDATED MACHINE TOOL CORP., Rochester, N. Y.; engine lathes, machines 3,888,465

CONTINENTAL-DIAMOND FI- BRE CO., Newark, Del.; in- sulating material 79,789

CONTINENTAL MACHINES, INC., Minneapolis, Minn.; machines 274,349

CONTINENTAL MOTORS CORP., Muskegon, Mich.; engines & parts..... 46,726,914

CONTINENTAL RUBBER CO., Erie, Pa.; rubber deflectors.. 23,832

CONTINENTAL STEEL CORP., Canton, Ohio; plate sheets... 59,200

COOK ELECTRIC CO., Chicago, Ill.; switchboards, jacks.... 131,623

COPPERWELD STEEL CO., Glassport, Pa.; steel..... 275,945

CORBIN SCREW CORP., New Britain, Conn.; ammunition components 114,495

CORBITT CO., Henderson, N. C.; trucks, trailers 3,715,691

C. COWLES & CO., New Haven, Conn.; artillery materiel.... 31,063

COWLES TOOL CO., Cleveland, Ohio; tools 16,017

ARTHUR A. CRAFTS CO., INC., Boston, Mass.; gages..... 29,900

Looking at this PRIORITY THING *from another angle*

Ingenuity, not just more men, machines and material, is a way out of priority delays. "Dag" colloidal graphite conserves vital material and relieves production bottlenecks.

Savings up to fifty per cent reported on assembly and run-in of tool machines and engines—Bulletin No. 112 T

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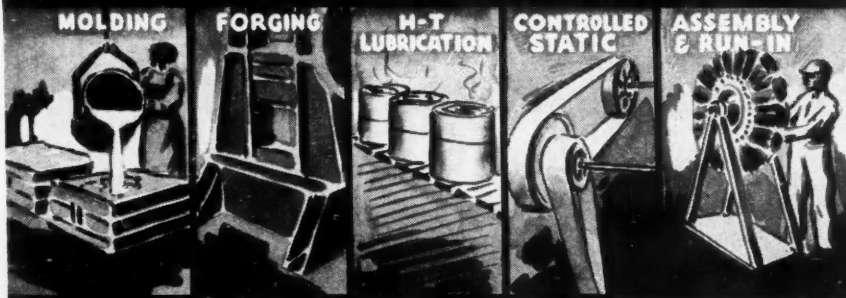
ACHESON COLLOIDS CORPORATION
PORT HURON, MICH.

"Dag" is a registered trade mark of the Acheson Colloids Corporation

reducing explosion hazard—Bulletin No. 270 T

"Dag" colloidal graphite takes over the load of lubrication at 400° F. and upwards, temperatures at which petroleum oils burn—Bulletin No. 130 T

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"NORMA-HOFFMANN"

IN THE FRONT LINE *of American Defense*

Today—as in the First World War—NORMA-HOFFMANN PRECISION methods and facilities are contributing accuracy, speed-ability, frictionless operation and dependability to practically every mechanical activity in the program of National Defense.

Day and night, the NORMA-HOFFMANN factory is turning out PRECISION BEARINGS that find their place in the machine tools and machinery producing essential equipment and supplies for army, navy and air forces; in battleships, cruisers, destroyers, submarines, aircraft carriers and other naval craft; in bombers, fighters, scout planes, trainers and transports; in anti-aircraft guns for land and naval operations; in gun mounts, gun-fire control and other ordnance equipment; in tanks and motor transport; and in telegraph, telephone, radio and photographic apparatus.

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PRECISION BALL • ROLLER AND THRUST BEARINGS

CRANE CO., Chicago, Ill.; valves	483,170	ammunition components	1,211,024	Buffalo, N. Y.; airplanes & parts	243,302,123
CRAWFORD AUSTIN MFG. CO., Waco, Texas; hammocks and cots.....	3,743,921	CROWN IRON WORKS CO., Minneapolis, Minn.; pontoon sets	278,690	CURTISS PROPELLER DIV., Clifton, N. J.; propellers & parts	100,964,045
CRAWFORD MFG. CO., Richmond, Va.; mattress covers, small arms materiel	356,208	CRUCIBLE STEEL CO. OF AMERICA, New York, N. Y.; steel and ordnance materiel	13,542,341	ST. LOUIS AIRPLANE DIV., Robertson, Mo.; airplanes...	4,026,043
CRESCENT BROS. CORP., Phila., Pa.; corrugated cartons	13,585	CULLEN FRIESTEDT CO., Chicago, Ill.; welding equipment	10,523	WRIGHT AERONAUTICAL CORP., New York, N. Y.; engines & parts.....	497,530,624
CRESCENT INSULATED WIRE & CABLE CO., Trenton, N. J.; electric cable.....	557,785	CUMMINS DIESEL ENGINE CORP. OF N. Y., Bronx, N. Y.; generator sets and spare parts	214,600	CUSHMAN MOTOR WORKS, Lincoln, Neb.; ammunition components	582,600
CRESCENT TOOL CO., Jamestown, N. Y.; pliers and wrenches	240,362	JAMES CUNNINGHAM SON & CO., Rochester, N. Y.; carriage assemblies for machine guns	215,180	CUYAHOGA SPRING CO., Cleveland, Ohio; small arms materiel	17,002
CRESCENT TRUCK CO., Lebanon, Pa.; electric truck....	33,694	CURTIS WRIGHT CORP., New York, N. Y.		CYCLONE FENCE CO., Waukegan, Ill.; fencing.....	61,998
CHARLES E. CROFOOT GEAR CORP., South Easton, Mass.; gears	14,490	CURTISS AEROPLANE DIV.,			
CROSBY CO., Buffalo, N. Y.;				DART TRUCK CO., Kansas City, Mo.; tank body trucks.....	28,900

DAVENPORT BESSLER CORP., Davenport, Iowa; flanges....	790,059	DELTA ELECTRIC CO., Marion, Ind.; electric lanterns.....	78,792	DENISON ENGINEERING CO., Columbus, Ohio; hydraulic machines	941,086
DETROIT BEVEL GEAR CO., Detroit, Mich.; gears.....	47,529	DETROIT BROACH CO., INC., Detroit, Mich.; broaches....	45,918	DETROIT TAP & TOOL CO., Detroit, Mich.; gages.....	13,037
DE VILBISS CO., Toledo, Ohio; paint spraying units.....	33,237	DE WALT PRODUCTS CORP., Lancaster, Pa.; machines....	14,335	DIAMOND T MOTOR CAR CO., Chicago, Ill.; trucks, buses..	35,256,618
DIEHL MFG. CO., Elizabethport, N. J.; automotive equipment	25,010	EUGENE DIETZGEN CO., Chicago, Ill.; engineers' transits	404,553	HENRY DISSTON & SONS, INC., Phila., Pa.; armor plates & files.....	1,243,919
JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.; writing pencils, cups.....	49,751	DODGE MFG. CORP., Mishawaka, Ind.; chock assemblies	53,155	DOEHLER DIE CASTING CO., New York, N. Y.; ammunition & dies.....	843,840
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ECLIPSE AIR BRUSH CO., INC., Newark, N. J.; machines	16,314				

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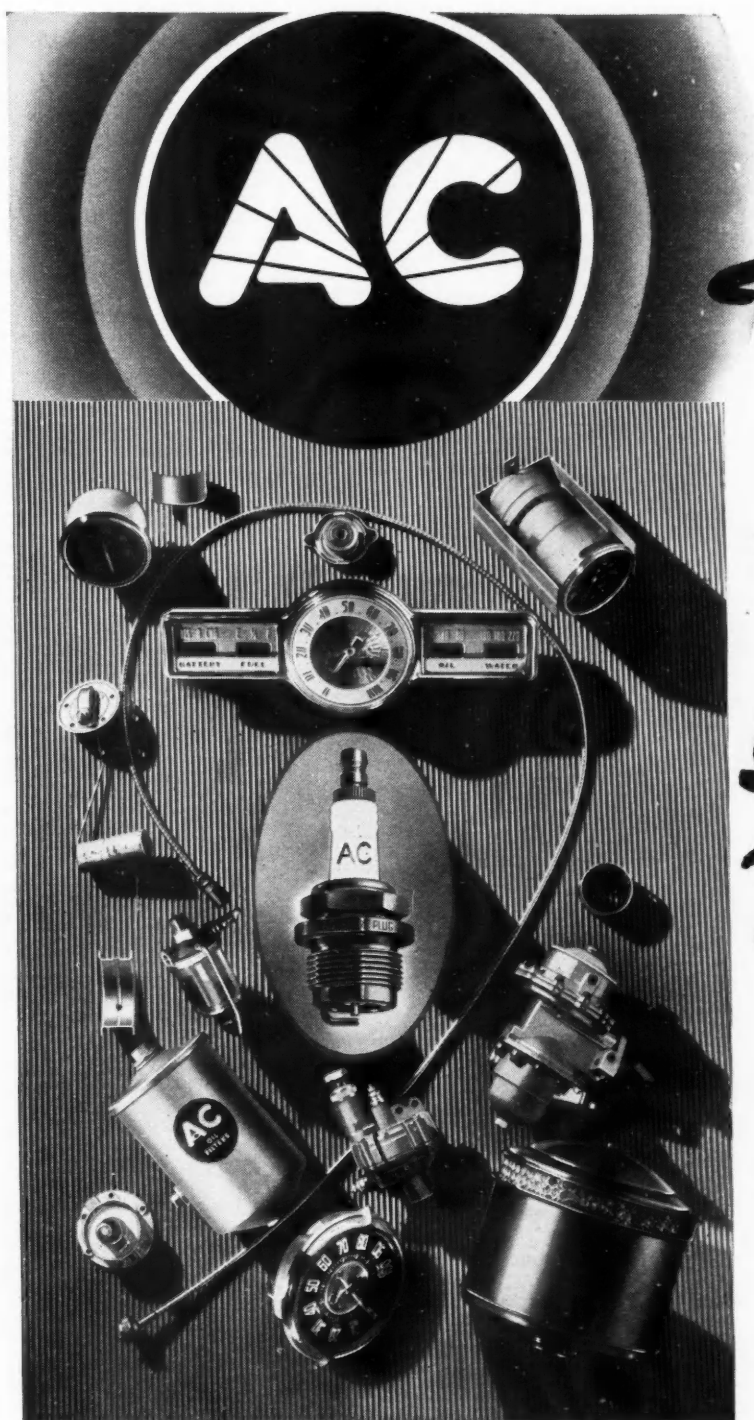
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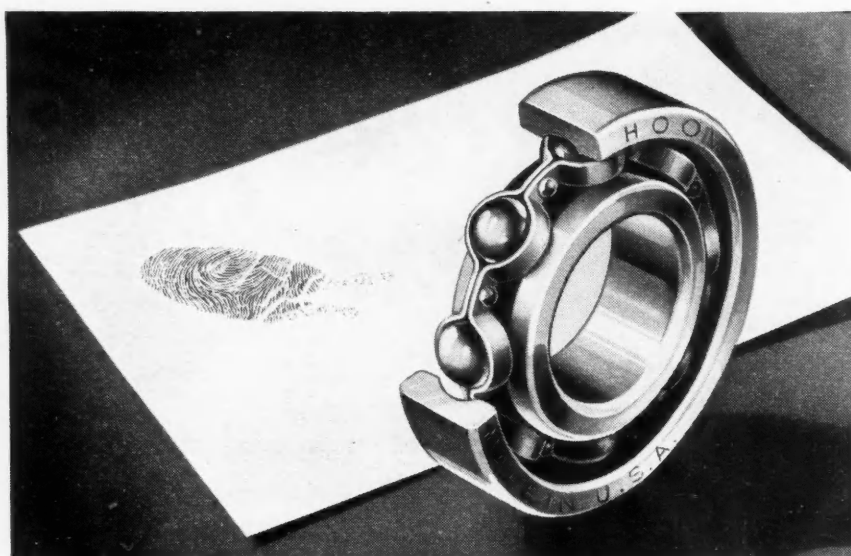
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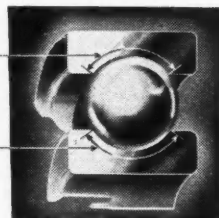


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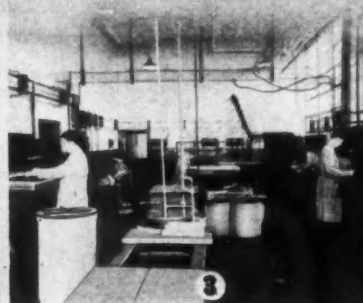
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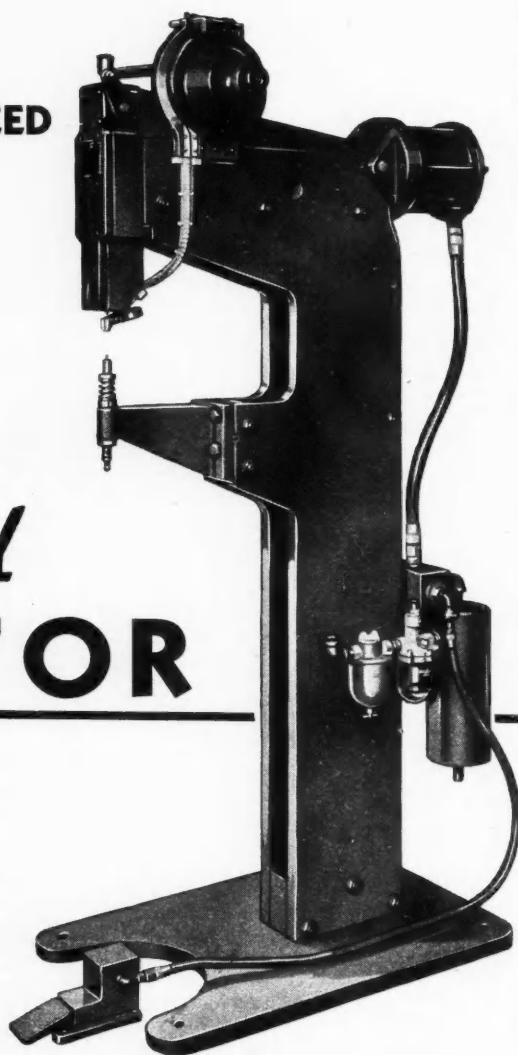
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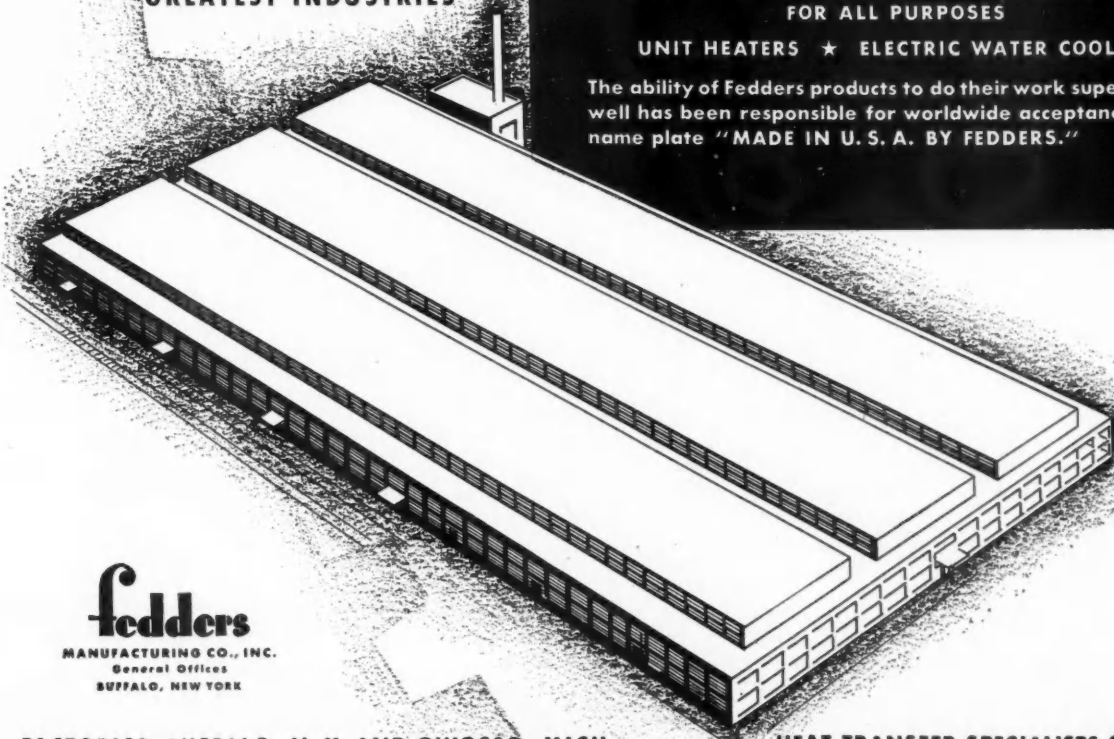
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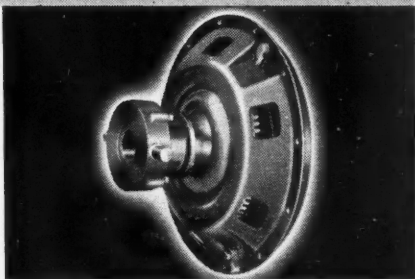
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KINGSBURY MACHINE TOOLS CORP. , Keene, N. H.; machines	177,978
KINGSBURY MACHINE WORKS, INC. , Phila., Pa.; bearing thrust shoes	25,393
KING-SEELEY CORP. , Ann Arbor, Mich.; eliminators & valves	229,787

FOR NATIONAL DEFENSE OR YOUR DAILY NEEDS

CLUTCHES FOR THE NATION

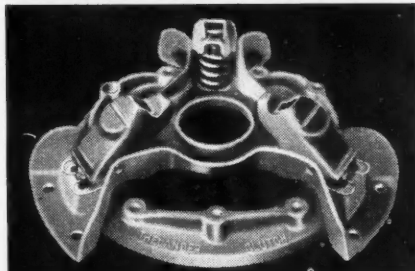
"CONSTANT PRESSURE" CLUTCH

Modern design in step with the future—for crawler and heavy wheel tractors, tanks and industrial applications. Exclusive, resilient "wear-compensator," introduced and patented by Atwood, cuts down field adjustments and maintenance expense. Greatly minimizes facing wear. Smooth engagement with lower engaging pressure. Especially engineered for your application.



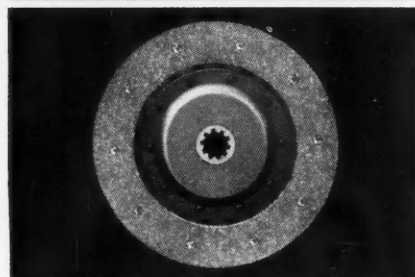
"SPRING-LOADED" CLUTCH

—for light to heavy-duty service on crawler or wheel-type tractors, trucks, tanks, passenger cars, etc. 13 improved features, including cushioned engagement, turbulent ventilating action, minimized pedal pressure, reduction of friction and pivot point deflection. 25% less weight, 30% fewer parts.



"HYDRO-DAMPENER" DRIVEN MEMBER

—radically new clutch plate that's already a proven performer for trucks and passenger cars. Patented hydraulic feature absorbs sound and shock. Let Atwood's skilled engineers help solve your clutch problem—write, wire or phone today!



ATWOOD-THELANDER
THE FASTEST GROWING NAME IN THE CLUTCH INDUSTRY

Another **ATWOOD** Product
AUBURN MANUFACTURING CO. AUBURN INDIANA
DIVISION OF ATWOOD VACUUM MACHINE CO., ROCKFORD, ILLINOIS
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Service ... that keeps our nation moving forward!

In the busses, trucks and passenger cars that are so important for serving civilian operations in the Defense Program . . . as well as in military mechanized equipment . . . Spicer products are helping deliver an ever-increasing measure of speed and power. We pledge our resources to the continuing attention of large and small customers alike, on any production demands the future may bring to America's great automotive industry.

Spicer Manufacturing Corporation • Toledo, Ohio



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Spicer
SERVICE

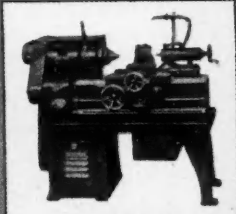
BROWN-LIPE
CLUTCHES and
TRANSMISSIONS

SALISBURY
FRONT and REAR
AXLES

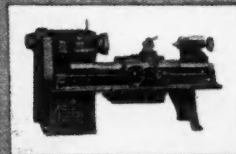
SPICER
UNIVERSAL
JOINTS

PARISH
FRAMES
READING, PA.

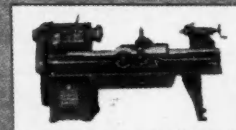
KINGSTON PRODUCTS CORP. , Kokomo, Ind.; artillery am- munition	805,000	EQUIPMENT CO. DIV. OF LA CROSSE BOILER CO. , La Crosse, Wis.; trail- ers	198,931
KINNER MOTORS, INC. , Glen- dale, Cal.; aircraft engines & spare parts	968,278	LAKE ERIE ENGINEERING CORP. , Buffalo, N. Y.; hy- draulic forming press.....	98,745
KIRK & BLUM MFG. CO. , Cin- cinnati, Ohio; equipment for field ranges	293,929	LAMSON CORP. , Syracuse, N. Y.; small arms ammuni- tion	1,750,404
W. B. KNIGHT MACHINERY CO. , St. Louis, Mo.; milling & boring machines	24,298	LANDIS TOOL CO. , Waynes- boro, Pa.; machines	1,090,833
KOPPERS COMPANY AMERICAN HAMMERED PISTON RING DIV. , Balti- more, Md.; piston rings	10,063	LA POINTE MACHINE TOOL CO. , Hudson, Mass.; ma- chines	419,597
BARTLETT HAYWARD DIV. , Baltimore, Md.; gun car- riages	3,724,930	LARSON TOOL & STAMPING CO. , Attleboro, Mass.; angle- tubes, outlet valve guards ..	10,600
KRAEUTER & CO., INC. , New- ark, N. J.; cutters, pliers ..	36,809	LA SALLE STEEL CO. , Ham- mond, Ind.; steel	228,881
LA CROSSE TRAILER &		LATROBE ELECTRIC STEEL CO. , New York, N. Y.; tool	



LeBlond 15"
Rapid Production Lathe



LeBlond 17"
Rapid Production Lathe



LeBlond 20"
Rapid Production Lathe

LeBLOND LATHES *are getting FASTER Everyday, too*

In the race against time, LeBlond lathes come out the winner. Take the LeBlond Rapid Production Lathes (13", 17", and 20"), for example. These speedy lathes have won recognition all over the country as production doublers par excellence. And yet, with all their speed, there is no sacrifice of accuracy. For the Rapid Production Lathes, like all LeBlond machine tools, are rigidly constructed to turn work with infinite precision at gruelling speeds... fast, accurate production year after year.

THE R. K. LeBLOND MACHINE TOOL CO.
Cincinnati, Ohio

Chicago Office
20 N. Wacker Dr.
STA 5561



New York Office
103 Lafayette St.
Canal 6-5281

Largest Manufacturer of a Complete Line of Lathes

steel	81,359
LAVINE GEAR CO. , Milwau- kee, Wis.; trailers	2,181,064
LEACH CO. , Oshkosh, Wis.; reel units	520,330
R. K. LeBLOND MACHINE TOOL CO. , Cincinnati, Ohio; lathes	684,756
LEE RUBBER & TIRE CO. REPUBLIC RUBBER DIV. , Youngstown, Ohio; oil suc- tion hose	143,360
LEECE NEVILLE CO. , Clevel- and, Ohio; generator & panel assemblies	3,271,992
LEEDS AND NORTHRUP CO. , Phila., Pa.; furnaces, record- ing instruments	41,440
LEES BRADNER CO. , Clevel- and, Ohio; milling machine	100,653
LEHMANN MACHINE CO. , St. Louis, Mo.; lathes	39,751
LEIMAN BROS., INC. , Newark, N. J.; pumps	10,608
LELAND GIFFORD CO. , Worcester, Mass.; drilling machines	144,637
LE ROI CO. , Milwaukee, Wis.; compressors & parts	2,338,957
LEVENE MOTOR CO. , Phila., Pa.; ammeters, distributors & switches	17,321
LEWIS ENGINEERING CO. , Naugatuck, Conn.; indica- tors, switches	47,112
LEWIS-SHEPARD SALES CORP. , Watertown, Mass.; trucks, storage racks	11,910
LINCOLN ELECTRIC CO. , Cleveland, Ohio; welders ..	449,920
LINCOLN ENGINEERING CO. , Baltimore, Md.; automotive equipment	422,974
LINDBERG ENGINEERING CO. , Chicago, Ill.; electric furnaces	374,112
LINDE AIR PRODUCTS CO. , New York, N. Y.; welding equipment	62,062
LINK AVIATION DEVICES, INC. , Binghamton, N. Y.; wheel type trainers	50,450
LINK BELT CORP. IND. DIV. , Indianapolis, Ind.; ammunition components	270,243
LINN CORP. , Oneonta, N. Y.; trucks	61,229
LOCKHEED AIRCRAFT CORP. , Burbank, Calif.; pursuit planes & spare parts	190,792,566
LODGE & SHIPLEY MACHINE TOOL CO. , Cincinnati, Ohio; engine lathes	1,456,059
LOGAN CO. , Louisville, Ky.; cots, mattresses, beds	470,613
LOGANSPOUT MACHINE, INC. , Logansport, Ind.; shav- ing machines	331,766
LOUDEN MACHINERY CO. , Albany, N. Y.; conveyor sys- tems	35,106
LUFKIN RULE CO. , Saginaw, Mich.; gages	295,875
LUKENS STEEL CO. , Coates- ville, Pa.; steel plates, blocks, caps	4,366,156
LYON METAL PRODUCTS, INC. , Aurora, Ill.; shelving..	808,369
MCCORD RADIATOR & MFG. CO. , Detroit, Mich.; small arms materiel	958,584
McGILL MFG. CO. , Valparaiso, Ind.; bearings	18,223
McKAY CO. , Pittsburgh, Pa.; chains & fittings	1,077,375
McKENNA METALS CO. , Lat- robe, Pa.; lathes	28,784
McKIERNAN-TERRY CORP. , Dover, N. J.; staking ma- chines	128,846
McLAREN SCREW PRODUCTS CO. , Detroit, Mich.; ammu- nition components	15,379
MACK MFG. CORP. , Long Island City, N. Y.; trucks ..	17,378,308
MACKINTOSH HEMPHILL CO. , Pittsburgh, Pa.; class & steel castings	42,241
MACLEOD CO. , Cincinnati, Ohio; dust collecting system	11,494



PERFECT CIRCLES ON DEFENSE!

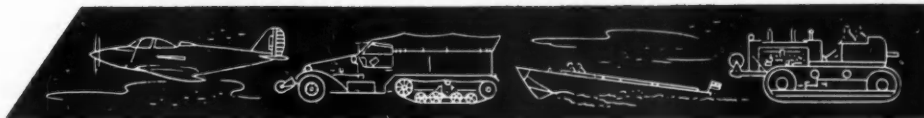
In this historic era of mechanized defense, the automotive engineer plays a leading and important role most vital to the security of the nation. Upon his knowledge, his experience, and his ability rests a tremendous share of the responsibilities that go with defense measures . . . on land, at sea, and in the air.

And it is gratifying to us that *Perfect Circle Piston Rings* are the predominating choice of automotive engineers the country over. For in the mobile units of the army and the navy—airplanes, marine engines . . . field cars, trucks and tractors . . . *Perfect Circles* meet the most exacting piston ring requirements.

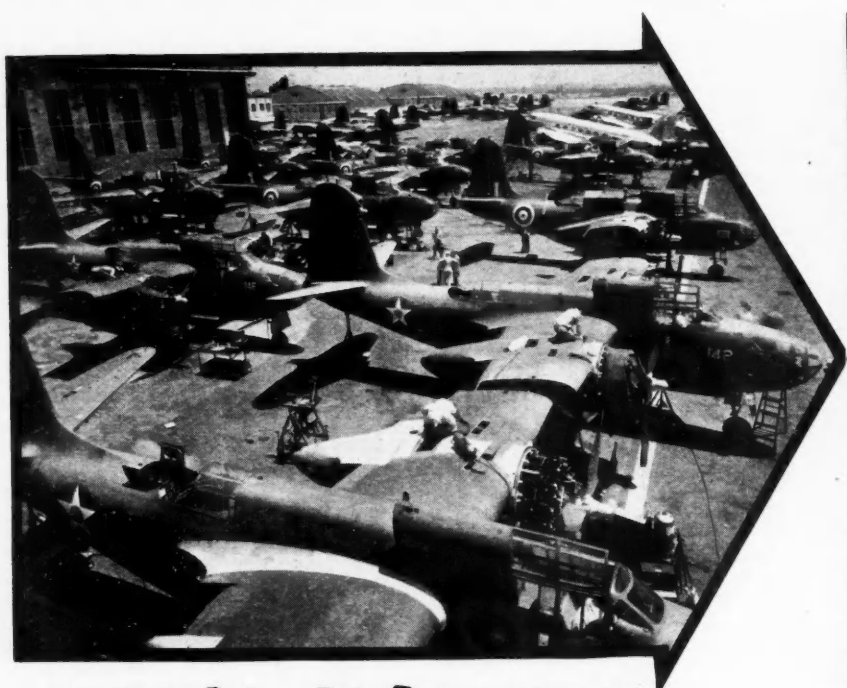
Our pride in the fact that *Perfect Circle Piston Rings* have so evidently won the approval of America's outstanding engineers is tempered with a sense of profound obligation: namely, always to produce this vital engine part to an unsurpassed quality and performance . . . so that in peace or war America's mechanized defense shall ever be the finest in the world.

THE PERFECT CIRCLE COMPANIES, HAGERSTOWN, IND., U. S. A. AND TORONTO, CAN.

Perfect  Circle
PISTON RINGS



MADISON-KIPP CORP., Madison, Wis.; die castings	15,780	spare parts	296,729,248
MAGNAFLUX CORP., Chicago, Ill.; tools	407,380	MASTER ELECTRIC CO., Dayton, Ohio; generator motors	89,203
MAGNUS TOOL & DIE CO., Newark, N. J.; tools	10,525	MATHEWS CONVEYOR CO., Ellwood City, Pa.; racks & tables	10,730
MAINE STEEL, INC., Portland, Maine; fittings, wire rope, mooring	50,160	MATTATUCK MFG. CO., Waterbury, Conn.; set-back pins	17,800
MALL TOOL CO., Chicago, Ill.; band saws	461,446	JAS. H. MATTHEWS & CO., Pittsburgh, Pa.; stamping steel figures & letters	27,066
MALLINCKRODT CHEMICAL WORKS, St. Louis, Mo.; drugs	38,680	MATTISON MACHINE WORKS, Rockford, Ill.; grinders	49,661
P. R. MALLORY & CO., INC., Indianapolis, Ind.; control assemblies	996,699	FRED MEDART MFG. CO., St. Louis, Mo.; metal lockers	91,751
MANUFACTURERS BRUSH CO., Cleveland, Ohio; brushes	46,932	MEILI BLUMBERG CORP., New Holstein, Wis.; trailers	85,528
MARMON HERRINGTON, INC., Indianapolis, Ind.; trucks	191,926	MERCER RUBBER CO., Hamilton Square, N. J.; pneumatic & water hose	77,180
GLENN L. MARTIN CO., Baltimore, Md.; airplanes and		MERCK & CO., Rahway, N. J.; drugs	326,984



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WHETHER you are making airplanes or automobiles, welding equipment or wheels—anything that requires quick, thorough metal cleaning or degreasing—Blakeslee equipment can help you do a better job. Frequently a Blakeslee survey of your parts washing or degreasing methods can show you how to gain hours in your production. For perfect cleaning before painting, assembly, plating, finishing, and after quenching, machining, polishing, forming, etc., Blakeslee equipment is the answer. Why not get the facts now? Write for free literature. Ask about a Blakeslee survey today.

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MERCURY MFG. CO., Chicago, Ill.; trucks & trailers	184,871
MESTA MACHINE CO., Pittsburgh, Pa.; artillery materiel	10,388,140
METAL & THERMIT CORP., Jersey City, N. J.; welding electrodes	23,735
METAL SPECIALTIES CO., Cincinnati, Ohio; artillery ammunition components	760,972
MICHIGAN TOOL CO., Detroit, Mich.; cutters	538,022
MICROMATIC HONE CORP., Detroit, Mich.; machines	12,555
MIDVALE CO., Philadelphia, Pa.; artillery materiel	19,370,662
MID-WEST LOCOMOTIVE WORKS, Hamilton, Ohio; locomotives	35,000
ALEXANDER MILBURN CO., Baltimore, Md.; oxacetylene torches	83,031
A. J. MILLER AUTO CRUISER TRAILER CO., Bradenton, Fla.; trailers	486,305
MILLER RUBBER CO., INC., Akron, Ohio; rubber gloves	23,505
MILLERS FALLS CO., Greenfield, Mass.; calipers, dividers, gages, etc.	73,322
MILWAUKEE ELECTRIC TOOL CORP., Milwaukee, Wis.; electric drills	57,249
MILWAUKEE SADDLERY CO., Milwaukee, Wis.; cantle bags	182,191
MINE SAFETY APPLIANCES CO., Pittsburgh, Pa.; breathing apparatus, submarine escape app., tools	1,767,856
MINNEAPOLIS-MOLINE POWER IMPLEMENT CO., Minneapolis, Minn.; tractors	28,029
MINNESOTA MINING & MFG. CO., tape, flint paper	271,997
MITCHELL & SMITH, INC., Detroit, Mich.; compressed cork	15,216
MODERN MACHINE TOOL & DIE CO., Bridgeport, Conn.; dies	16,800
MOELLER INSTRUMENT CO., INC., Richmond Hill, N. Y.; industrial thermometers	41,900
MOLDED INSULATION CO., Phila., Pa.; ammunition components	333,706
MOLINE FORGE, INC., Moline, Ill.; ammunition components	496,000
MONARCH MACHINE TOOL CO., Sidney, Ohio; engine lathes	1,681,371
MONSANTO CHEMICAL CO., Springfield, Mass.; ammunition parts	175,777
MOORE SPECIAL TOOL CO., Bridgeport, Conn.; tools	23,027
MORGAN ENGINEERING CO., Alliance, Ohio; electric cranes	118,540
MORSE CHAIN CO., Ithaca, N. Y.; chains & sprockets	25,575
MORSE TWIST DRILL & MACHINE CO., New Bedford, Mass.; tools	32,998
MORTON MFG. CO., Muskegon Heights, Mich.; machines	1,890,251
MOTO SCOOT MFG. CO., Chicago, Ill.; cots, rails, rods	242,739
MOTOR TOOL MFG. CO., Detroit, Mich.; tools, jigs, fixtures	42,320
MOTOR WHEEL CORP., Lansing, Mich.; wheels, discs, rims	691,532
MUELLER BRASS CO., Port Huron, Mich.; naval brass, forgings	819,749
MULLINGS MFG. CO., Salem, Ohio; artillery ammunition components	4,980,300
MUNDET CORK CORP., Brooklyn, N. Y.; detonator cushions, space blocks	101,043
CHARLES MUNDT & SONS, Jersey City, N. J.; metal	32,564
NARRAGANSETT MACHINE CO., Providence, R. I.; small arms materiel	27,587
NASH KELVINATOR, Detroit, Mich.; trailers	1,029,915

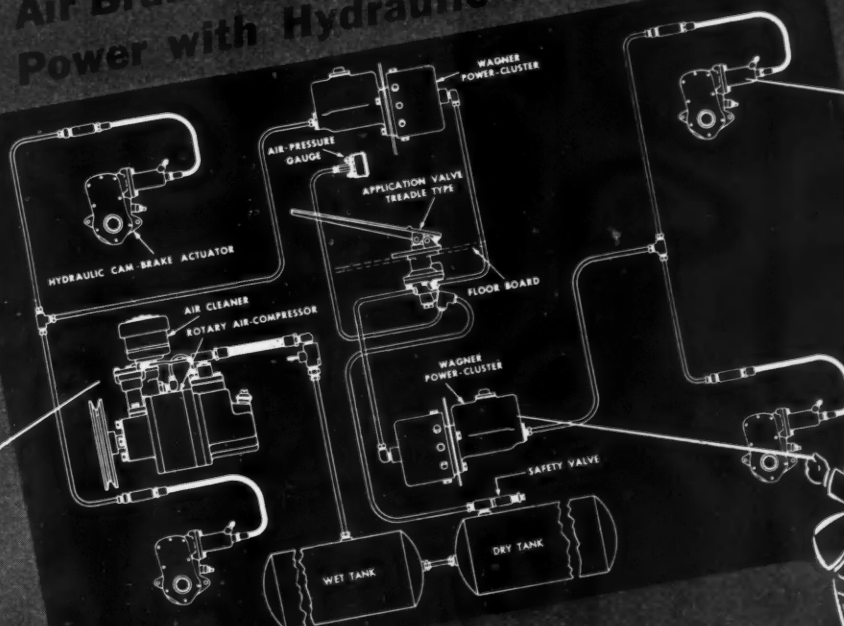
WAGNER HYDRAIR BRAKE

The Air Brake System that Combines
Air Power with Hydraulic Actuation

THE ONLY
SYSTEM WITH
THE ROTARY
COMPRESSOR

THE
HYDRAULIC CAM-
BRAKE ACTUATOR,
ANOTHER EXCLUSIVE
WAGNER FEATURE

THE WAGNER
POWER-CLUS-
TER CONVERTS
AIR POWER TO
HYDRAULIC
PRESSURE



The Wagner Hydair Brake System is a new development in the field of commercial vehicle braking, combining the principles of air power and hydraulic actuation as applied to cam-brake-equipped vehicles. The advantages of both hydraulic brakes and air brakes have been proven and accepted during long use by commercial vehicle manufacturers and truck and fleet operators.

Hydraulic brake actuation on trucks, tractors, and buses has heretofore been necessarily restricted to the limits of the internal cylinder Lockheed hydraulic brake. Cam-operated brakes, actuated by air, have been used on the larger models beyond the capacity of the internal hydraulic brake.

The Wagner Electric Corporation now offers hydraulic brake actuation for all commercial vehicles regardless of weight. This new system, the Wagner Hydair Brake, illustrated diagrammatically above, combines all the advantages of both air brakes and hydraulic brakes. The Wagner Hydair Brake utilizes compressed air, as supplied by the rotary air compressor, figure 1, below, to furnish the power needed to operate the system. This power contained in the compressed air is converted into hydraulic line-

pressure (by means of two power clusters, figure 2, below) which operates the hydraulic cam-brake actuators, figure 3, mounted outside the wheel-brake units. The hydraulic cam-brake actuators each contain a Lockheed hydraulic wheel-cylinder of the latest type and a standard type slack adjuster which converts hydraulic line-pressure into the mechanical force used to actuate (by means of a splined shaft) the cam type of brake.

The Wagner HYDRAIR Brake is available as original equipment for factory installation; also in kits for field installations. Any one of the three types of Wagner application valves, treadle type (as illustrated below, figure 4), lever-type, or push type, may be used to control the application of air pressure to the Wagner power clusters of proper capacity to serve the hydraulic cam-brake actuators which are selected to produce the desired input to the cam brakes.

Two Other Wagner Air Brake Systems

Two additional air brake systems, the Wagner Air-Hydraulic Brake and the Wagner Straight-Air Brake, make up a complete line of air-powered brakes offered by Wagner.

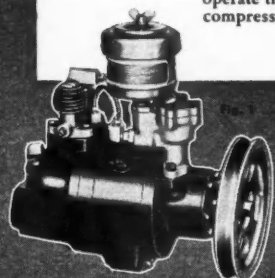


FIG. 1
ROTARY
AIR COMPRESSOR

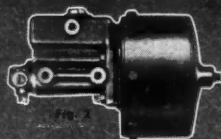


FIG. 2
WAGNER
POWER CLUSTER

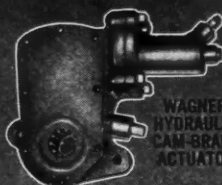


FIG. 3
WAGNER
HYDRAULIC
CAM-BRAKE
ACTUATOR



FIG. 4
APPLICA-
TION VALVE, TREADLE TYPE

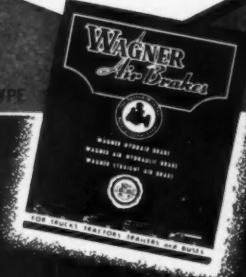
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SEND FOR NEW
AIR BRAKE
BOOKLET KU-50



Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

BRAKES MOTORS TRANSFORMERS FANS



NASHUA MFG. CO., Boston, Mass.; cotton cloth 88,750
 NATIONAL ACME CO., Cleveland, Ohio; tools & machines 2,319,602
 NATIONAL AUTOMOTIVE FIBRES, INC., Detroit, Mich.; cotton filled comforters 127,560
 NATIONAL BATTERY CO. GOULD COMMERCIAL DIV., St. Paul, Minn.; storage batteries 1,322,804
 NATIONAL BROACH & MACHINE CO., Detroit, Mich.; machines 278,066
 NATIONAL CARBIDE CORP., New York, N. Y.; calcium-carbide 25,018
 NATIONAL CARBON CO., New York, N. Y.; flashlights, batteries 244,242

NATIONAL CASH REGISTER CO., Dayton, Ohio; ammunition components 12,091
 NATIONAL CYLINDER GAS CO., Chicago, Ill.; cutting machines, acetylene 194,876
 NATIONAL ELECTRIC PRODUCTS CORP., Pittsburgh, Pa.; electric cable 2,576,663
 NATIONAL ELECTRIC WELDING MACHINES CO., Bay City, Mich.; welding machines 20,420
 NATIONAL ENAMELING & STAMPING CO., Milwaukee, Wis.; kitchenware 266,427
 NATIONAL ENGINEERING CO., Chicago, Ill.; sand mixing machine 14,701
 NATIONAL FORGE & ORDINANCE CO., Irvine, Pa.; steel crankshafts 1,218,088

NATIONAL LEAD CO., Baltimore, Md.; lead, solder 163,323
 NATIONAL LOCK WASHER CO., Newark, N. J.; ammunition components 47,155
 NATIONAL MACHINE PRODUCTS CO., Detroit, Mich.; brass nuts 72,895
 NATIONAL MALLEABLE & STEEL CASTING CO., Cleveland, Ohio; ammunition components 2,460,819
 NATIONAL PNEUMATIC CO., INC., New York, N. Y.; infantry weapons 10,313
 NATIONAL STAMPING CO., Detroit, Mich.; angletubes .. 2,826,225
 NATIONAL SUPPLY CO. SUPERIOR ENGINE DIV., Phila., Pa.; engines 939,962
 NATIONAL TUBE CO., Pittsburgh, Pa.; ammunition components 9,895,769
 NATIONAL TWIST DRILL & TOOL CO., Detroit, Mich.; twist drills 703,329
 HERMAN NELSON CORP., Moline, Ill.; small arms 15,268
 N. P. NELSON IRON WORKS, INC., Passaic, N. J.; road construction equipment 19,850
 NEW BRITAIN MACHINE CO., New Britain, Conn.; automatic chucking machines... 183,382
 N. J. ZINC CO., New York, N. Y.; zinc 251,753
 NEW YORK RUBBER CORP., New York, N. Y.; pneumatic life rafts 41,496
 NIAGARA MACHINE & TOOL WORKS, Buffalo, N. Y.; presses, shears 37,065
 NIAGARA MOTORS CORP., Dunkirk, N. Y.; forgings 28,360
 NIAGARA SEARCHLIGHT CO., INC., Niagara Falls, N. Y.; flashlights 64,311
 NICHOLSON FILE CO., Providence, R. I.; files & rasps .. 460,352
 NOBLE & WESTBROOK MFG. CO., E. Hartford, Conn.; marking machines 33,175
 NOBLITT SPARKES INDUSTRIES, INC., Columbus, Ind.; ammunition components 596,073
 NORDBERG MFG. CO., Milwaukee, Wis.; ordnance equipment 11,998,776
 NORRIS STAMPING & MFG. CO., Los Angeles, Calif.; aluminum cartridge containers 1,336,580
 NORTH AMERICAN AVIATION, INC., Inglewood, Calif.; airplanes & parts.... 303,440,714
 NORTH AMERICAN SMELTING CO., Phila., Pa.; metal ingots 226,381
 NORTH & JUDD MFG. CO., New Britain, Conn.; buckles 36,067
 NORTHCILL CO., INC., Glendale, Calif.; shears 27,491
 NORTON CO., Worcester, Mass.; machines 328,888
 NORWALK CO., INC., South Norwalk, Conn.; electric air compressor 43,987
 OHIO INJECTOR CO., Wadsworth, Ohio; composition values 134,527
 OHIO SEAMLESS TUBE CO., Shelby, Ohio; steel tubing .. 24,636
 OKONITE CO., New York, N. Y.; electric cable 3,815,336
 OLIVER FARM EQUIPMENT CO., Chicago, Ill.; metal packing crates 803,848
 OLIVER INSTRUMENT CO., Adrian, Mich.; grinding machines 21,618
 OLIVER IRON & STEEL CORP., Pittsburgh, Pa.; bolts & nuts 478,591
 OLIVER MACHINERY CO., Grand Rapids, Mich.; lathes 70,145
 D. W. ONAN & SONS, Minneapolis, Minn.; power units .. 300,533
 ONSRUD MACHINE WORKS, INC., Chicago, Ill.; routers.. 136,744
 ORTON CRANE & SHOVEL CO., Chicago, Ill.; cranes .. 199,123

**Chicago Rivet
 AUTOMATIC SETTER**
DOUBLES PRODUCTION RATE
AT Curtiss-Wright

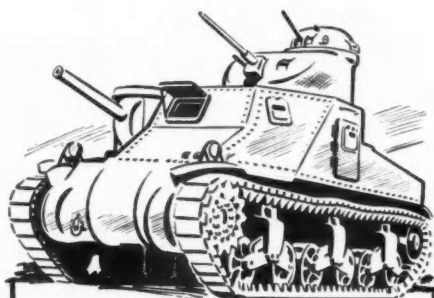
Where formerly one man inserted a rivet and another clinched it with a portable device, this new Chicago Rivet machine feeds, inserts and clinches a solid aluminum alloy rivet with each riveting stroke ... When Chicago Rivet machines are used for industrial or aircraft assemblies, the results are universally the same ... **faster production at lower cost.**

CHICAGO RIVET & MACHINE CO.
 9612 W. JACKSON BLVD., BELLWOOD, ILL. (Chicago Suburb)
 Manufacturers of tubular, split and aircraft rivets and automatic single and multiple rivet setters.

Model 140
 used for setting
 3/16" solid rivets in
 reinforcement plate
 of Curtiss fighter.



GOVERNING ENGINE SPEED



Some Recent Applications of Pierce Governors for Defense Equipment

- Tanks
- Anti-Aircraft Searchlight Equipment
- Auxiliary Power Units on Aircraft
- Gun Turrets
- Generating Plants at Stations of C.A.A.
- Army Ordnance Field Repair Trucks

... on new units being designed for defense equipment—

... in new-product development against the time when the present "big job" is done—

... wherever *speed control* by engine governors enters into your design problem—

COME TO PIERCE for governors. We're equipped with facilities and experience to expedite the work of speed control design, however intricate the problem, however sensitive the degree of regulation required.

Provision for a governor drive outlet on any engine is desirable when designing. It is often very difficult to apply a governor where the engine manufacturer has not provided such an outlet. With the very wide use of governors on trucks, buses and various industrial applications this convenience is well worth consideration when designing for new production. Our data on this subject is yours for the asking.

THE PIERCE GOVERNOR COMPANY • 1637 OHIO AVENUE • ANDERSON, INDIANA

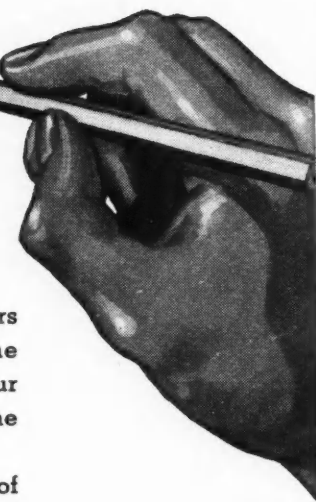
Pierce Governors

STANDARD SINCE 1913

OSBORN MFG. CO., Cleveland, Ohio; wire cleaning brushes	61,603	PACIFIC MILLS, Boston, Mass.; flannel shirting	4,805,392
OSGOOD CO., Marion, Ohio; services, cranes, shovels	260,951	PACKARD MOTOR CAR CO., Detroit, Mich.; Rolls Royce aeronautical engines	62,634,822
OSHKOSH 4-WHEEL DRIVE SALES AGENCY, Oshkosh, Wis.; tractor truck	16,500	PANGBORN CORP., Hagerstown, Md.; machines	48,638
OTIS STEEL CO., Cleveland, Ohio; structural steel	26,837	PANTASOTE CO., INC., Passaic, N. J.; processed cotton fabric	32,122
OUTBOARD MARINE & MFG. CO.		PARKER APPLIANCE CO., Cleveland, Ohio; tube benders	72,037
JOHNSON MOTORS DIV., Waukegan, Ill.; outboard motors	209,791	PARKER RUST PROOF CO., Detroit, Mich.; "Parkerizing" equipment	51,169
OWENS ILLINOIS GLASS CO., Alton, Ill.; tool parts	94,463	PARSONS CO., Detroit, Mich.; assemblies, metal parts	115,393
PAASCHE AIRBRUSH CO., INC., Chicago, Ill.; paint spraying equipment	10,218	PECK, STOW & WILCOX CO., Worthington, Conn.; ratchet braces	227,277
PACIFIC CAR & FOUNDRY CO., Renton, Wash.; railroad cars	54,745	PENNSYLVANIA FLEXIBLE	

Faithfully yours . . . and
your customers'

**Bendix
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PETERS ENGINEERING CO., Phila., Pa.; machines	19,990
PFAUDLER CO., Rochester, N. Y.; machinery	471,221
PHARIS TIRE & RUBBER CO., Newark, N. J.; tubes, tires	54,772
PHILCO CORP., Phila., Pa.; artillery ammunition components	2,101,355
PHOSPHOR BRONZE SMELTING CO., Phila., Pa.; phosphor bronze	10,979
PICK MFG. CO., West Bend, Wis.; target frames	163,370
PIONEER AIR COMPRESSOR, INC., New York, N. Y.; air compressors	14,414
PIQUA MUNISING WOOD PRODUCTS CO., Cleveland, Ohio; shelter tent poles	36,400
PITTSBURGH-DES MOINES STEEL CO., New York, N. Y.; steel standpipe	141,906
PITTSBURGH FORGINGS CO., Pittsburgh, Pa.; alloy steel forgings	12,135
PITTSBURGH PLATE GLASS CO.	
BRUSH DIV., Baltimore, Md.; brushes	303,533
PITTSBURGH STEEL CO., Pittsburgh, Pa.; seamless boiler tubes	617,083
PITTSBURGH STEEL FOUNDRY CO., Glassport, Pa.; steel anchors	431,298
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PLYMOUTH RUBBER CO., INC., Canton, Mass.; friction tape	13,785
POLLAK MANUFACTURING CO., Arlington, N. J.; armament equipment	1,771,322
POOR & CO.	
CANTON FORGE & AXLE WORKS, Canton, Ohio; artillery materiel	76,255
H. K. PORTER, INC., Pittsburgh, Pa.; machines	917,450
PORTLAND FORGE & FOUNDRY CO., Portland, Ind.; ammunition components	94,000
POTTER & JOHNSTON MACHINE CO., Pawtucket, R. I.; turret lathe	11,030
PRATT INDUSTRIES, INC., Frankfort, N. Y.; ammunition components	236,242
PRATT & WHITNEY DIV.	
NILES-BEMENT-POND CO., W. Hartford, Conn.; gages, machines	2,524,733
PRECISION SCIENTIFIC CO., Chicago, Ill.; laboratory equipment	252,885
PRESSED STEEL CAR CO., INC., Pittsburgh, Pa.; artillery ammunition components	1,230,000
PROCTOR & SCHWARTZ, INC., Phila., Pa.; dryers	63,635
PROTECTOSEAL CO. OF AMERICA, INC., Chicago, Ill.; gasoline cans	24,966
PUBLICKER COMMERCIAL ALCOHOL CO., Phila., Pa.; alcohol	170,094
PULMOSAN SAFETY EQUIPMENT CO., Brooklyn, N. Y.; filter respirators	58,034
PUMP ENGINEERING SERVICE CORP., Cleveland, Ohio; assemblies	72,471

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RADIO CORP. OF AMERICA, Camden, N. J.; radio receivers, tubes	11,922,300
RASMUSSEN MACHINE CO., INC., Racine, Wis.; hack saws	29,342
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RAYBESTOS-MANHATTAN, INC., Manheim, Pa.; asbestos cloth	409,323
MANHATTAN RUBBER MFG. DIV., Passaic, N. J.; fuel oil hose	101,206

RAY-O-VAC CO., Madison, Wis.; dry batteries	116,715
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REED PRENTICE CORP., Worcester, Mass.; engine lathes	3,053,278
REED SMALL TOOL WORKS, Worcester, Mass.; calipers & gages	13,934
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REMINGTON RAND, INC., Dist. of Col.; filing cabinets	29,337
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REPUBLIC AVIATION CORP., Farmingdale, L. I., N. Y.; pursuit airplanes & spare parts	65,355,249
REPUBLIC STEEL CORP., Cleveland, Ohio; small arms materiel, steel	1,885,020
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REVERE COPPER & BRASS CO., INC., New York, N. Y.; brass & copper	14,722,736
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RIVERSIDE METAL CO., Riverside, N. J.; nickel silver strip	19,787
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ROBBINS & MYERS, INC., Springfield, Ohio; hoists	19,389
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RUSTLESS IRON & STEEL CO., Baltimore, Md.; steel	67,692
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SAGINAW STAMPING & TOOL CO., Saginaw, Mich.; trailers	852,383
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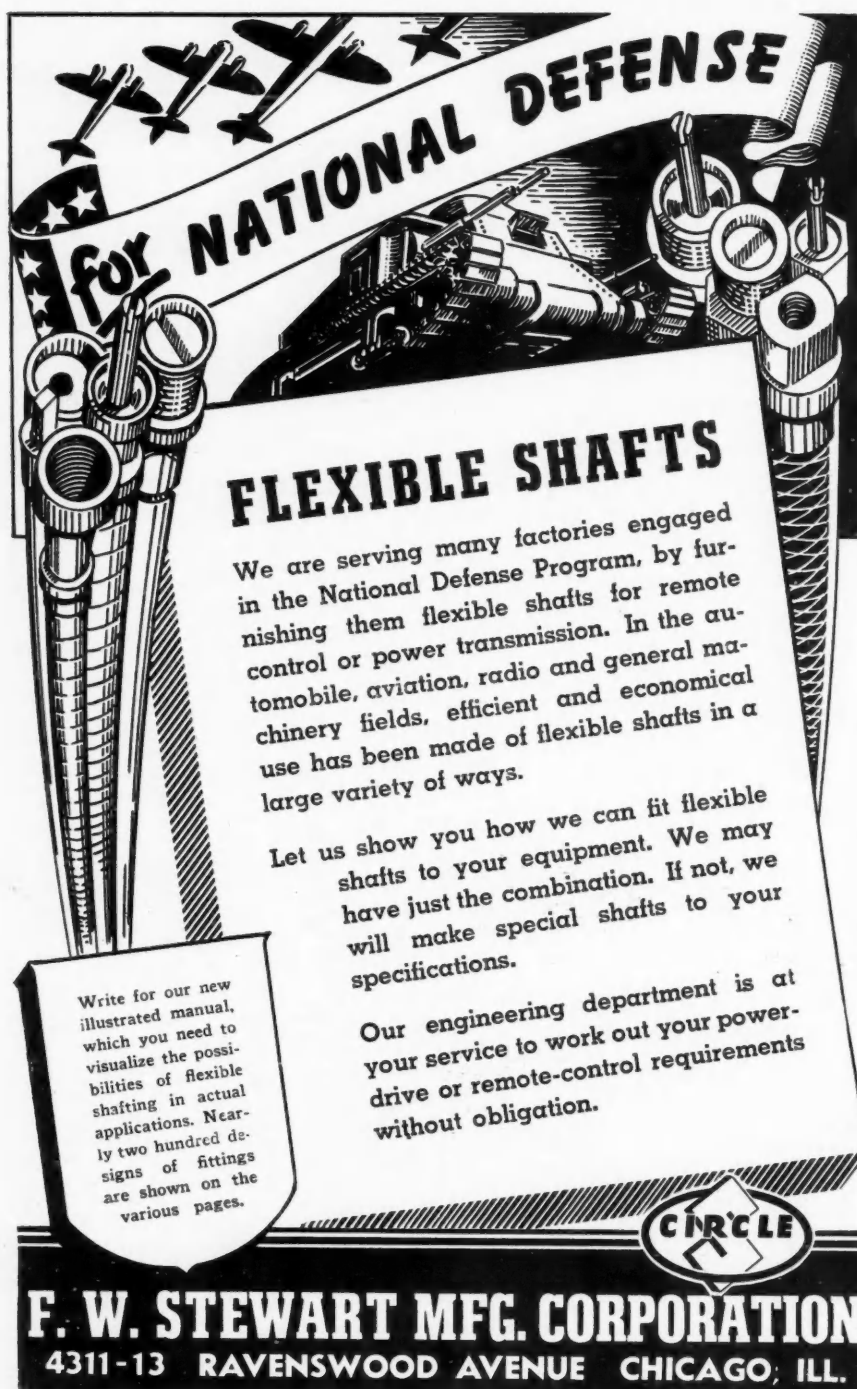


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SILENT HOIST WINCH & CRANE CO., Brooklyn, N. Y.; crane cars	114,332
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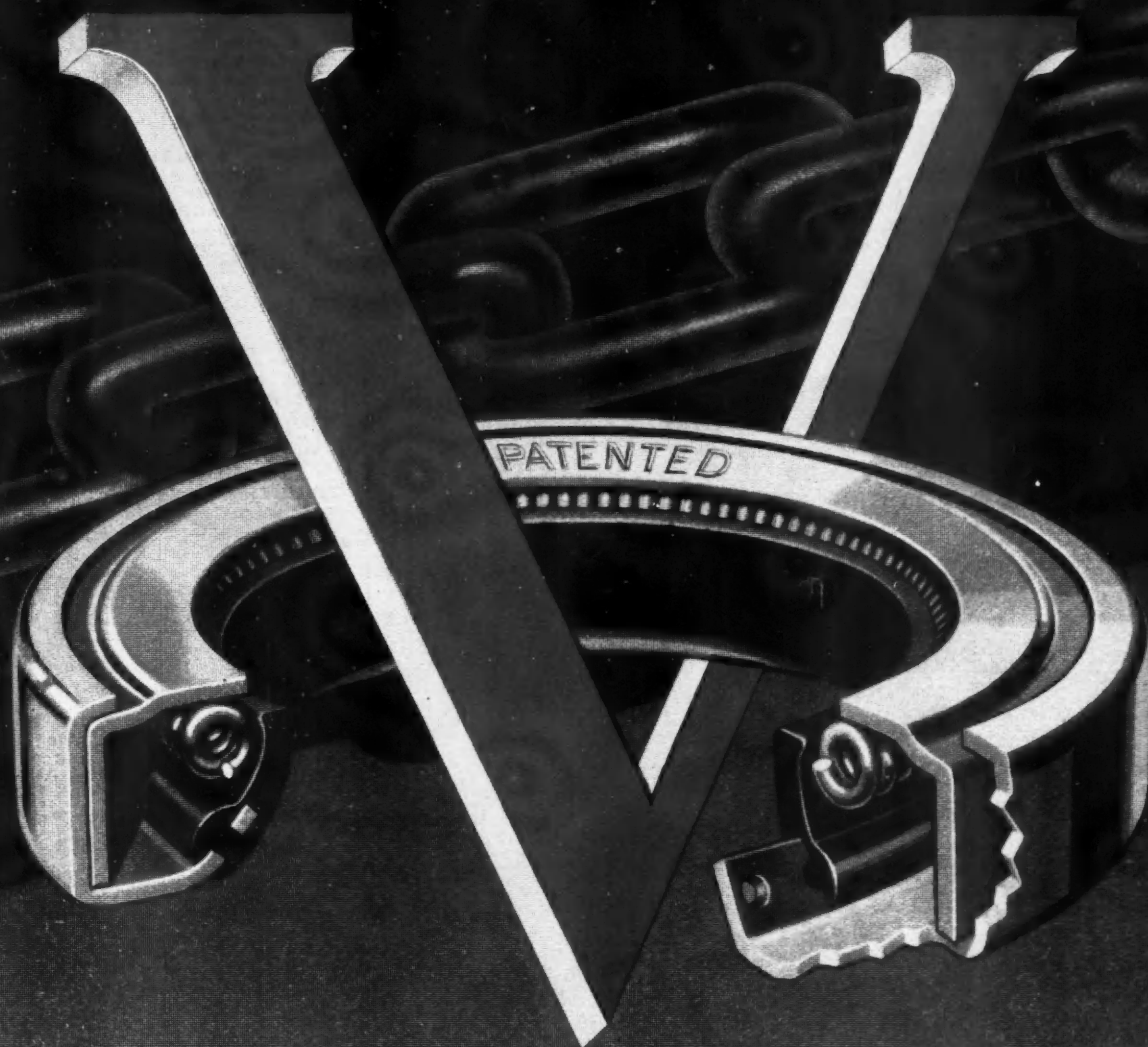
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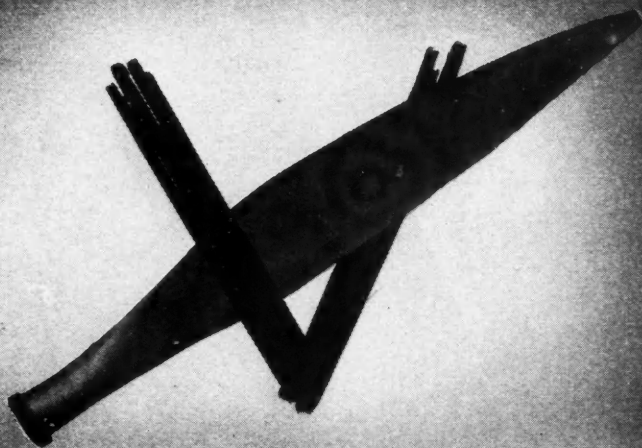
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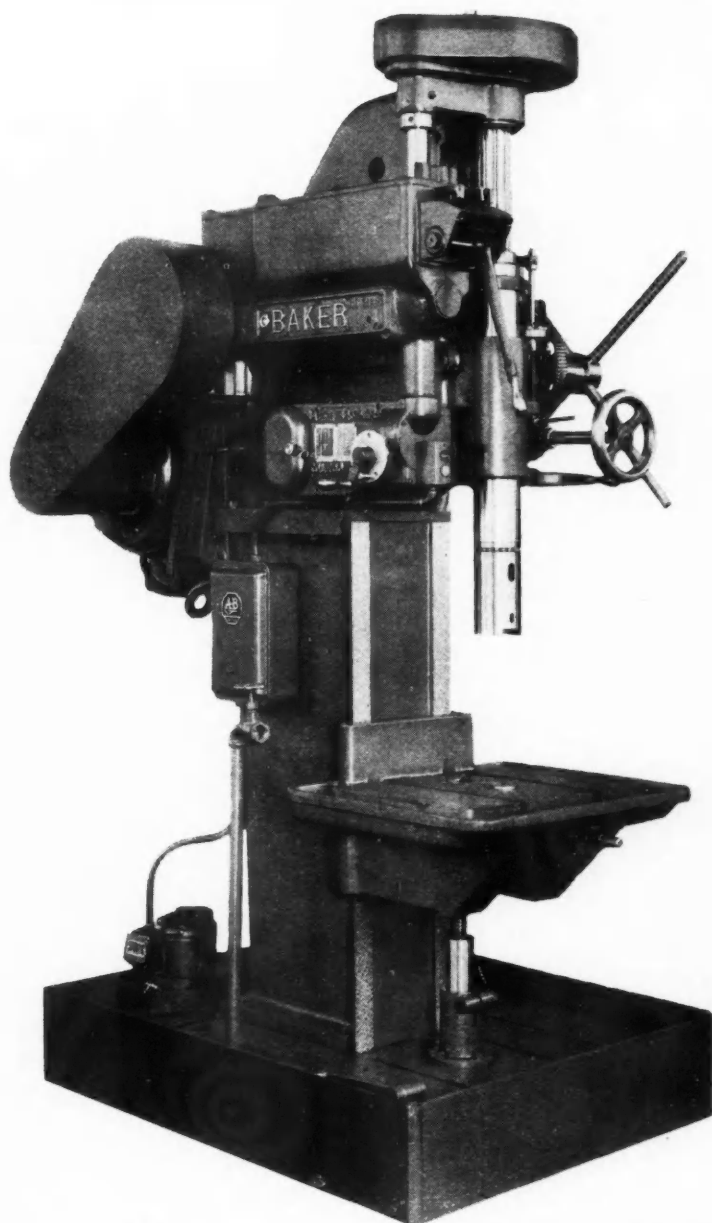
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UNIVERSAL CYCLOPS STEEL CORP., Bridgeville, Pa.; steel rods	835,760
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WARD LAFRANCE TRUCK CORP., Elmira, N. Y.; trucks	654,761
WARD LEONARD ELECTRIC CO., Mt. Vernon, N. Y.; portable rheostats	263,822
WARNER & SWASEY, Cleveland, Ohio; lathes.....	1,192,066
WARNER ELECTRIC BRAKE MFG. CO., Beloit, Wis.; artillery materiel	139,574
WATERBURY BUTTON CO., Waterbury, Conn.; cotton mattresses	65,348
WATERBURY FARREL FOUNDRY & MACHINE CO., Waterbury, Conn.; gaging machines	410,600
WATERHOUSE CO., Webster, Mass.; artillery materiel....	15,703
WATSON AUTOMOTIVE EQUIPMENT CO., Washington, D. C.; semi-trailers....	1,260,045

Motor Boat Show Cancelled

For the first time since the organization was formed in 1904, the National Association of Engine and Boat Mfrs. has been forced to cancel its annual motor boat show scheduled for January in New York City.

***We're in our 'teens, but —
we grew up almost overnight!***



Yes sir, we had a healthy, normal plant growth for 'teen years, caused by industry's cordial acceptance of "3C" electrical control apparatus.

Then along came DEFENSE—and almost overnight we grew, and grew, and grew!

And did we have "growing pains!"

Even before windows were in place in our plant additions, new men, new ma-

chines, new devices, all blended with our standard production into a smooth-working schedule.

We don't make armament nor munitions, but we do make electrical control apparatus for use on motors and vital machines responsible for "all out" production.

Some difficulties? Sure, we have 'em—who hasn't?

Deliveries? We're making them—not as fast as we'd like—but who's doing any better?

We're "in there, pitchin'"—just as anxious as ever to service your electrical control needs, and your requirements are being given just as careful attention as possible.

Our "grown-up" facilities are at your service.

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST.

CLEVELAND, OHIO

Production for Defense

(Continued from page 61)

including ¼-ton reconnaissance cars (jeeps), for which it is the major supplier with 18,600 on order, powder and projectile hoists, anti-aircraft gun breech housings and recoil cylinders for the Navy, 20 and 155-mm. shells, aircraft forgings and trailer coaches. Adapting its 60-hp. Americar engine to the jeep, Willys was able to build a combat vehicle that combines mobility

with ruggedness and power, and that can travel 60 m.p.h. The company also has converted part of its forge shop from steel to aluminum forgings, making it possible to handle a daily capacity of 40,000 lb. for aircraft manufacturers.

International Harvester Co., holding defense orders for \$55,000,000, has many defense activities spread among

its 15 U. S. plants. Army trucks are coming off assembly lines at Fort Wayne, Ind., 37 and 75 mm. shell forgings are being produced at West Pullman, Ill., and Milwaukee, and 155-mm. gun carriages are being assembled at Milwaukee. The company also has undertaken the manufacture of 20-mm. Hispano-Suiza aircraft machine guns, converting a one-time automotive warehouse for the purpose in St. Paul. International Harvester will subcontract 150 parts of the gun making only 12 parts.

White Motor Co., with \$58,000,000 in army truck orders, has delivered more than 4500 armored vehicles, many of them with half-track drive. Diamond T and Autocar also are big suppliers of armored scout cars and personnel carriers, their orders totaling more than \$30,000,000 each. Other manufacturers of motorized equipment are Marmon-Herrington, Federal and Reo, while Fruehauf Trailer Co. is turning out trailer units in large quantities.

First of the automotive companies to attain volume output on airframe parts was Briggs Mfg. Co., which has \$40,000,000 in orders for subassemblies from Boeing, Douglas and Vought-Sikorsky. From a nucleus in August, 1940, of three men who had gained aircraft manufacturing experience turning out military planes at the Briggs plant in England, the Briggs activity has expanded until it occupies 675,000 sq. ft. of a new building in Detroit. Using automotive principles, Briggs is utilizing automobile production mechanical dies for the fabrication of airframe parts. Thirty-two automotive body presses have been converted for aircraft work to speed production. Briggs' pioneer work in the development of aluminum alloy welding is an outgrowth of steel welding processes that had their origin in the welding of Ford bodies in 1923. Experimentation with aluminum alloy welding began in 1933 and it has now reached the point where Briggs employs it on a volume production basis, the first in the aircraft industry to do so. As an example, it takes 2 hr. to drill and rivet 30 holes in duralumin, while welders can do 24 to 30 holes per hr. Exact control of current, pressure and distance between welds make this possible.

The Vought-Sikorsky wing for Navy planes was designed for welded parts and its 3600 component parts require 2000 rivets. A similar Boeing airframe subassembly numbering 4800 parts requires 48,000 rivets. The great saving in production time is apparent. In making 70 duct work parts for Boeing, the number of rivets required was reduced from 8000 to 6000 by substitution of welding methods. Other automotive techniques converted to airframe construction have been an assembly line, constant flow of materials, single operation machinery, exact and close tolerances, interchangeability of parts, wide use of jigs and fixtures and the use of precision machinery for exacting operations.



America is definitely on the march to preserve the American way of life. Industrial history is in the making. American industry is living up to its well earned achievement "Past Master of the Assembly Line". Armaments and all its attendant needs are literally pouring out of factories, mills, plants and laboratories in a never ending life line. A life line that is destined to save the liberties of free people everywhere. There is little we of the hotel industry can actually do, but much we can help do in this mammoth project . . . and help we will, by maintaining "Service Under Stress" to eliminate the contagious grumblings of the indifferent . . . to refresh and restart each new day for a better work day the army of guests who nightly it is our privilege to house in the thirty-six AFFILIATED NATIONAL HOTELS.

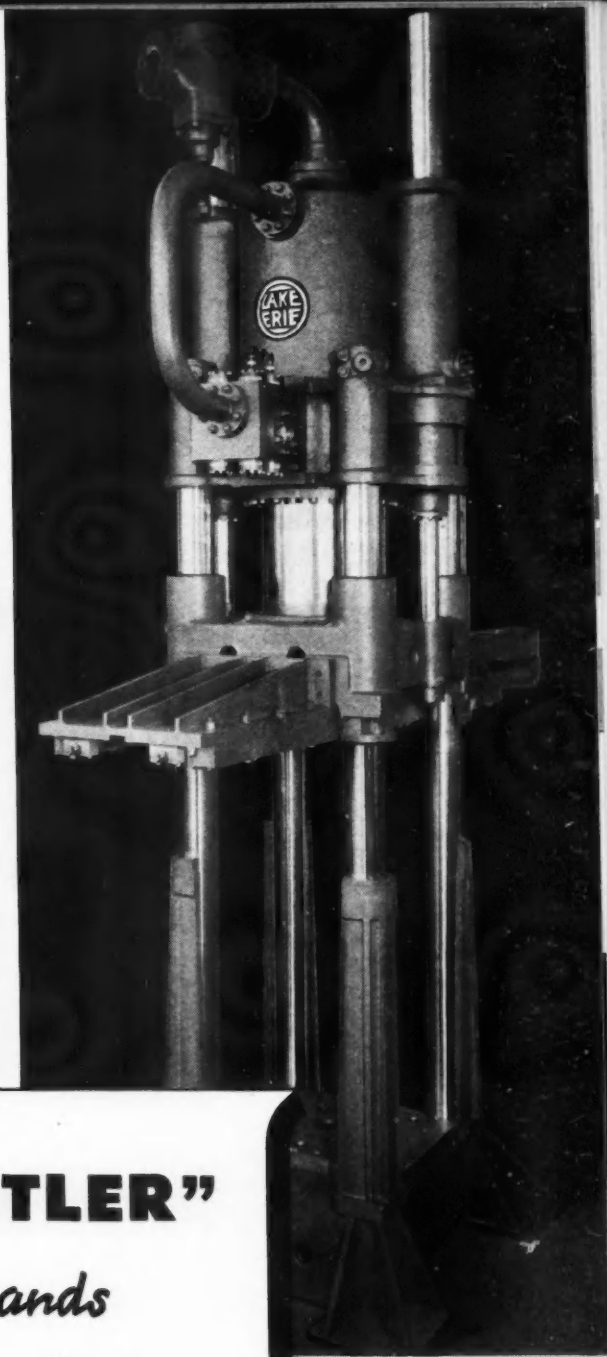
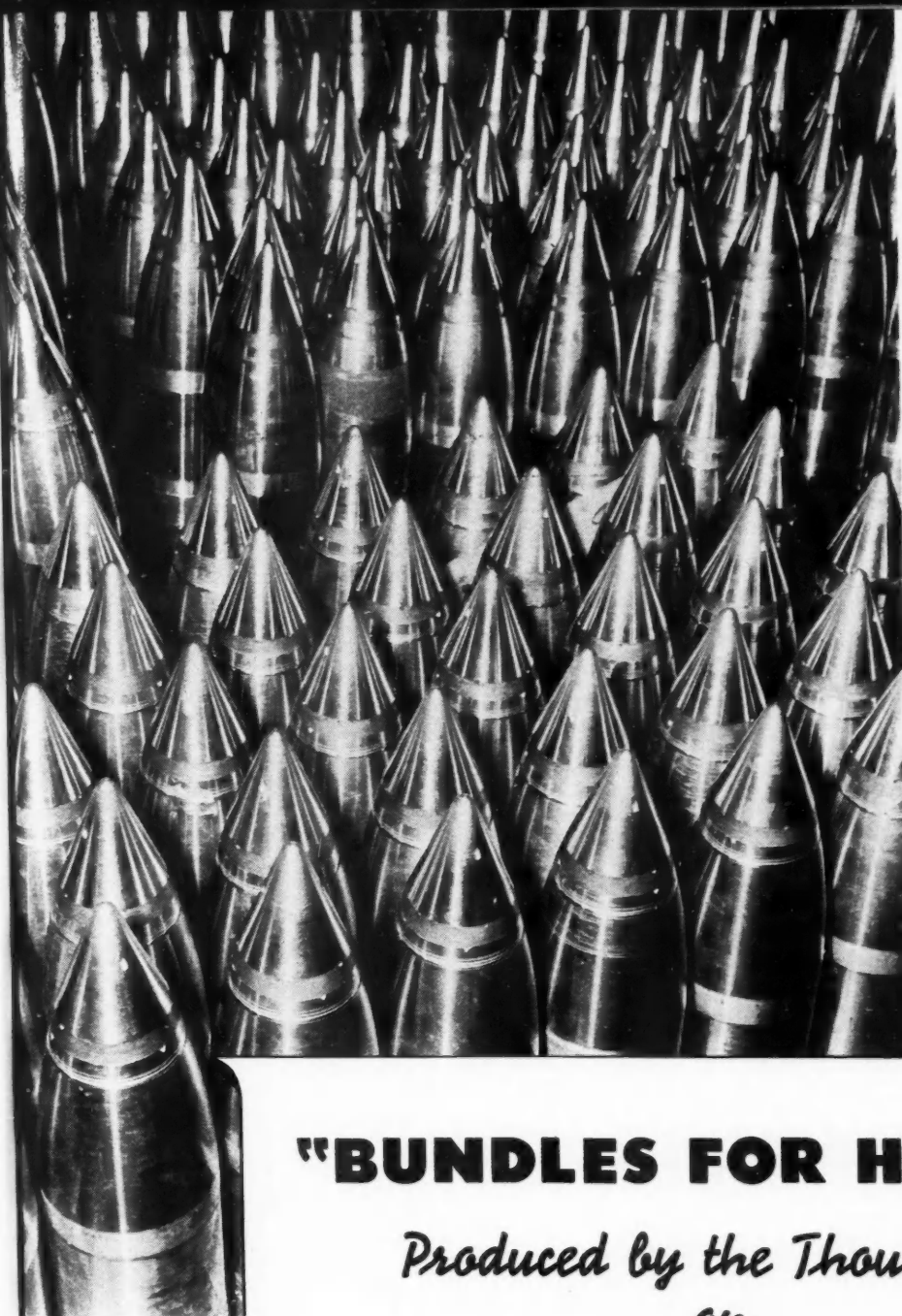
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DISTRICT OF COLUMBIA	SOUTH CAROLINA	HOTEL IRAN LAFITTE . . . Galveston
HOTEL WASHINGTON . . . Washington	HOTEL WADE HAMPTON . . . Columbia	CORONADO COURTS . . . Galveston
ILLINOIS	TEXAS	JACK TAR COURT . . . Galveston
HOTEL FAUST . . . Rockford	HOTEL ALICE . . . Alice	MIRAMAR COURT . . . Galveston
LOUISIANA	HOTEL STEPHEN F. AUSTIN . . . Austin	HOTEL CAVALIER . . . Galveston
JUNG HOTEL . . . New Orleans	HOTEL BOTTLES . . . Big Spring	HOTEL PLAZA . . . Laredo
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This Lake Erie 600 ton Shell Piercing Press is part of the complete line for shell production.

Volume manufacture of shells and cartridge cases offers another example of how it has become standard practice to tool up with Lake Erie Hydraulic Presses.

Complete, integrated setups have been developed for piercing, drawing and nosing shells, also for cupping, drawing, and heading cartridge cases.

Lake Erie performance has been proved and approved by successful use in America's foremost plants.

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Take advantage of triple savings resulting from on-the-job experience of Lake Erie engineers . . . high production speeds of Lake Erie Hydraulic Presses . . . standardized designs which shorten delivery time of Lake Erie Presses.



LAKE ERIE
Hydraulic Presses

The comparative complexity of aircraft construction is illustrated by the fact that a typical four-door sedan body has 1500 parts, including bolts and screws, while in a pair of Douglas wings there are more than 4500 parts in addition to 28,000 rivets, nuts and screws. An automobile door contains 2 man-hr. of labor, while the simplest airplane door requires 75 man-hr. Briggs employs 200 subcontractors in its airframe work.

Continental Motors Corp. is the holder of \$90,000,000 in defense contracts for aircraft and tank engines. This company had entered the aviation field several years before the national

emergency and was able to capitalize this experience in rehabilitating its former Detroit plant and getting into production on radial engines for aircraft and tanks in less than seven months. The company's Muskegon plant is 50 per cent on defense work and the Detroit plant is engaged in 100 per cent defense production.

Stewart-Warner Corp., which has \$14,000,000 in defense work on its books, made some cost estimates on shell fuses for the Picatinny Arsenal early in 1940 but finally threw the cost estimates away and filed a bid that won the order from the Ordnance Department. That order was completed in August, 1940,

and the company lost money on it. But through the experience gained as well as the company's skill in making precision parts, Stewart-Warner gained further fuse orders, for which it converted part of a vacant building and warehouse in Chicago as a manufacturing center. Three million fuses were delivered in the first 12 months of production. Four hundred women are employed on some of the work because of their dexterity in handling fine precision parts. A recent order was completed last May three weeks ahead of schedule. Stewart-Warner is producing lubricating equipment for the Army and Air Corps, submarine gages, radio parts and tank and truck instruments, which are in its normal line of activities, as well as such strictly defense items as bomb fuses, airplane instrument panels and heaters for bombers.

Largest single producer of artillery shells is the Budd Wheel Co., which has had to expand its Detroit plant for the manufacture of 60 and 105-mm. shell forgings. Now the company has \$36,000,000 in defense orders for shells, and truck wheels, hubs and brake drums. Budd entered the shell business in September, 1939, when it won a competitive bid for 50,000 shells from the Frankfort Arsenal. Contacts with the arsenal originally had been made through the furnishing of artillery wheels. Although Budd had no idle capacity at the time, it decided to enter the shell business and now defense comprises about 45 per cent of the company's total business.

Budd applied new techniques to shell manufacture. Induction heating of all forging bars not only eliminated scale but cut the operating time to 8 sec. for the 60-mm. shell. With its rapid expansion in shell manufacture, Budd faced the necessity for machine tools that were not immediately available. So the company's engineers utilized old machines that were available. As an example, they used 16-year-old rim shrinkers to put the rotating bands on shells. By adoption of these methods Budd cut the time from eight months for production of the first million shells to 55 days for the second million and only 45 days for the third million.

Kelsey-Hayes Wheel Co., with more than \$25,000,000 in Government orders, also is producing shells, hubs and military vehicle wheels that require forging operations. The company, which is engaged 75 per cent on defense work, is operating a new machine gun plant at Plymouth, Mich., as well as plants at Detroit and Jackson.

Timken-Detroit Axle Co., with 70 per cent of its activity on defense orders, entered the military picture in 1929 when it cooperated with the Ordnance Department and the Quartermaster Corps on developmental work. Army budgets at that time were scanty, so Timken bore much of the development expense. That cooperation proved foresighted, as the company has large orders for military truck axles, gun carriage parts, hubs, brake drums and



WHEN a prominent automotive manufacturer undertook to produce fuse detonator caps rigid inspection requirements against scratches and discoloration brought a hurry call for a Kerns service man to develop a suitable drawing compound. Careful chemical development brought these immediate results.

- 1—LESS BREAKAGE**
- 2—SCRATCHES ELIMINATED**
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We are anxious to demonstrate a KERN'S Drawing Compound on Your Toughest Job. Write or phone for test samples. No obligation.

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TROUBLE-FREE FASTENINGS

Obviously there can be no compromise with quality—no element of doubt—in the selection of fastenings upon which depend the safe, successful performance of aircraft and all defense products. Long the choice of America's important industries, HOLTITE fastenings are playing an increasingly vital part in the defense program.

Fully familiar with aviation requirements and government specifications, this plant is completely equipped to produce regular and special fastenings from SAE 2330, SAE 3135, SAE 4130 steel, brass and other alloys with Class 3 fit, and Cadmium plating to .0002" and .0003".

For accuracy, strength, uniformity and complete dependability specify HOLTITE on your next fastening order—regular or special.



CONTINENTAL SCREW CO

New Bedford, Mass. . . Warehouses at Detroit & Chattanooga

transmission and final drive units for tanks. The first order for high-speed adapters for artillery carriages was completed 113 days ahead of schedule. Timken-Detroit is now subcontracting with 81 companies for machining parts formerly made in its own plant, in order to speed production rates.

Thompson Products, Inc., maker of truck, tank and diesel engine parts, shell adapters and more than 1000 aircraft engine parts, is 60 per cent engaged in defense activity and is shipping Government orders at an annual rate of \$45,000,000. Experience with close aircraft finish tolerances has enabled the company to develop ma-

chines that will turn out fuel pump liners at a rate of 13 per hr. compared to the old rate of 3 an hr. Similarly, grinding operations on aircraft engine valves have been cut from 30 min. per valve to 36 sec. Plant additions have totaled 950,000 sq. ft.

The tire companies are cooperating extensively in the defense effort by manufacturing a wide variety of products for the Army and Navy in addition to thousands of truck tires for military vehicles. Among the items produced by all the major rubber companies are aircraft tires, gas masks, bullet-sealing fuel tanks for aircraft, rubber parts for airplanes, bullet-seal-

ing fuel hose for combat vehicles, and synthetic rubber, which is sun and oil-resistant, for various engine uses.

In addition to their adaptation of rubber for war-time usages, some of the tire companies are engaged in manufacturing activities far removed from rubber. Goodyear Tire & Rubber Co. has an important role in the bomber program through its subsidiary, the Goodyear Aircraft Corp. Taking over the airship dock at Akron, as well as new buildings at Akron and Litchfield Park, Ariz., the company is turning out ailerons, rudders, stabilizers and tail surfaces for Martin, Grumman, Consolidated and Curtiss. The company also is making aircraft flotation gear and rubber boats for planes forced down at sea as well as pontoons.

Goodyear has an order for 500 barrage balloons, having made observation balloons in the last war. A fabric mill in New Bedford, Mass., also was reopened after being shut down two years. Goodyear is building semi-rigid airships for naval coastal patrol, having made 140 blimps since their manufacture first was begun in 1911.

B. F. Goodrich Co. is a prime source of supply for rubber tracks and bogie wheels for army half-track scout cars and personnel carriers. Goodrich also makes latex foam padding, 75 lb. of which is required for each medium tank interior. De-icers for military aircraft are produced at a newly expanded Los Angeles plant, while insulators for submarines are made at Cadillac, Mich.

Firestone Tire & Rubber Co., always prominent in the rubber field, has turned its engineering talent to another line of activity in undertaking the manufacture of gun mounts and carriages for the 40-mm. Bofors anti-aircraft gun which is being made by Chrysler. These are being turned out in a new 10-acre plant in Akron. Firestone also is the largest manufacturer of machine gun bullet clip belts at Akron, Fall River, Mass., and Wyandotte, Mich.

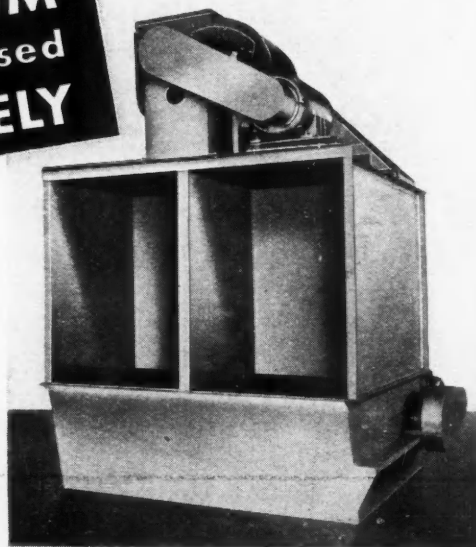
U. S. Rubber Co., also a large defense producer, is making rubber tank track blocks, sponge rubber crash padding for tanks and truck tires for military vehicles, the latter comprising about 27 per cent of the company's total tire production. The bullet-resistant tires and tubes supplied for combat vehicles make it possible to proceed as far as 50 miles at speeds up to 40 m.p.h. even after shrapnel or machine gun bullets have penetrated the tire.

Electric Auto-Lite Co. is utilizing many of its 18 plants for various types of defense activity on orders for \$25,000,000. In addition to its normal line of products which find usage in military vehicles, such as lighting and ignition systems, instruments, gages, spark plugs and batteries, it also is turning out many strictly military items. Among these are blackout lighting equipment, which is manufactured at a new plant in Cincinnati, fire control apparatus, projectiles, shell fuses, boosters and trigger arm assemblies.

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The Hydro-Whirl is made for either stand grinding or flexible shaft grinding. The latter design is illustrated above. In single, double, or greater multiples.

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